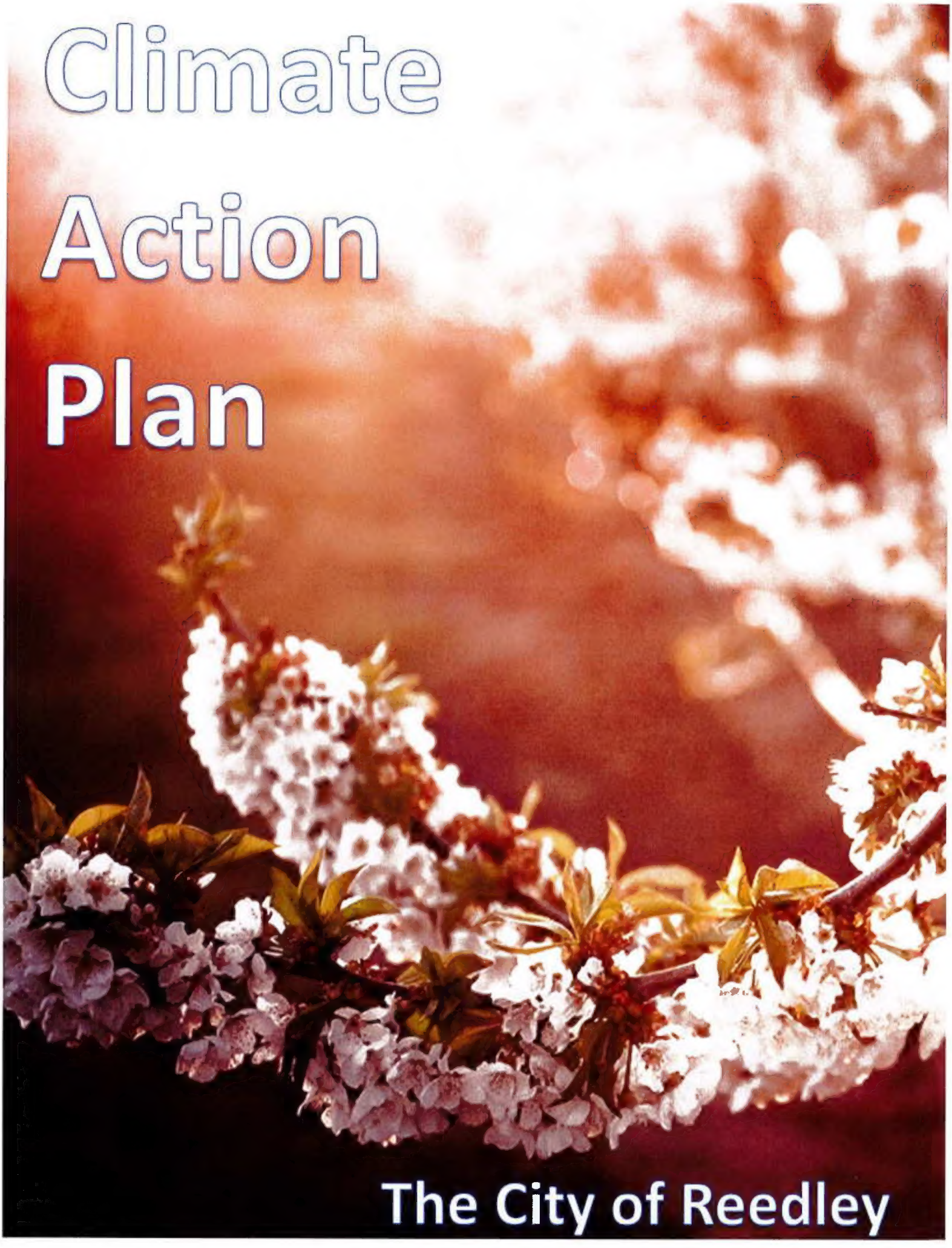
Climate Action Plan



The City of Reedley

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Executive Summary

Cities are responsible for more than 70 percent (%) of global energy-related carbon dioxide (CO_2) emissions, according to the Greenhouse Gas Protocol (2012). Because of this, urbanized areas have important responsibility for reducing greenhouse gas (GHG) emissions and climate change. The City of Reedley recognizes the importance of responding to climate change. This Climate Action Plan (CAP) establishes Reedley as a model for similar sized cities in the State of California.

The City's recently adopted General Plan 2030 Update contains goals and policies (COSP 4.11.1 & COSP 4.11.2) directed toward a reduction of GHG emissions by at least 15 %. Additionally, as part of the environmental analysis leading to the certified Program Environmental Impact Report (SCH #2010031106) was the inclusion of a mitigation measure (GHG-1, Mitigation Monitoring and Reporting Program, February 18, 2014) directing the City to establish a Climate Action Plan. The establishment of this Climate Action Plan complete with "...measures to reduce GHG emissions from municipal, business and community activities by at least 15 % by 2020..." was furthermore carried forward in the Reedley General Plan 2030 Update Work/Implementation Plan (WIP).

The City of Reedley, as demonstrated in this CAP, has achieved the required GHG emission reductions from municipal operations as well as compliance with California Assembly Bill (AB) 32, The Global Warming Solutions Act of 2006 and has established a checklist to ensure these required reductions are achieved community-wide. While the City has achieved the target reduction objectives to date, growth presents a real challenge in meeting future goals. In order to enable future reductions, the City has created a "Greenhouse Gas Reduction Compliance Checklist" for all projects in the City limits to self-certify a 20 % GHG reduction.

The City of Reedley, in collaboration with Pacific Gas and Electric Company, and International Council for Local Environmental Initiatives for Sustainability USA (ICLEI), compiled the *City of Reedley Government Operations Greenhouse Gas Emissions Inventory 2005 Baseline Year Narrative Report* (City of Reedley 2012). The AB 32 Scoping Plan suggests reduction efforts begin with an emissions reduction goal of 15 % below "current" levels by 2020. This CAP defines "baseline" conditions ("current" levels) as 2005, relying on the extensive data available in the City's 2005 Baseline Narrative (City of Reedley 2012).

The City of Reedley has been able to reduce GHG emissions 23 % from 2005 baseline through a series of strategic municipal operational changes. This CAP provides the political and environmental context (CEQA 15183.35(b) for global climate change as it relates to GHGs, details how and where emissions reductions were achieved, and identifies tools to meet the City's 2020 and future 2030 reduction goals. The City of Reedley's emission reduction goals are:

- Near-term: reduce GHG emissions by 15 % of 2005 levels by 2020;
- Mid-term: reduce GHG emissions by 50 % below 2005 levels by 2030; and
- Long-term: reduce GHG emissions by 80 % below 2005 levels by 2050.

The City is also committing to updating its GHG emissions inventory every 3 to 5 years, as recommended by ICLEI.

Introduction to Climate Change

According to the United States Environmental Protection Agency (USEPA), "Climate change refers to any significant change in the measures of climate lasting for an extended period of time" (USEPA 2014b). Typical examples of climate change, as shown in Figure 1, include ambient temperature increases, arctic amplification, abnormal rain and snowfall, extreme weather events, rising ocean temperatures, sea level rise, ocean acidification, and declining arctic sea ice. These climate change events create financial, operational and often health impacts.

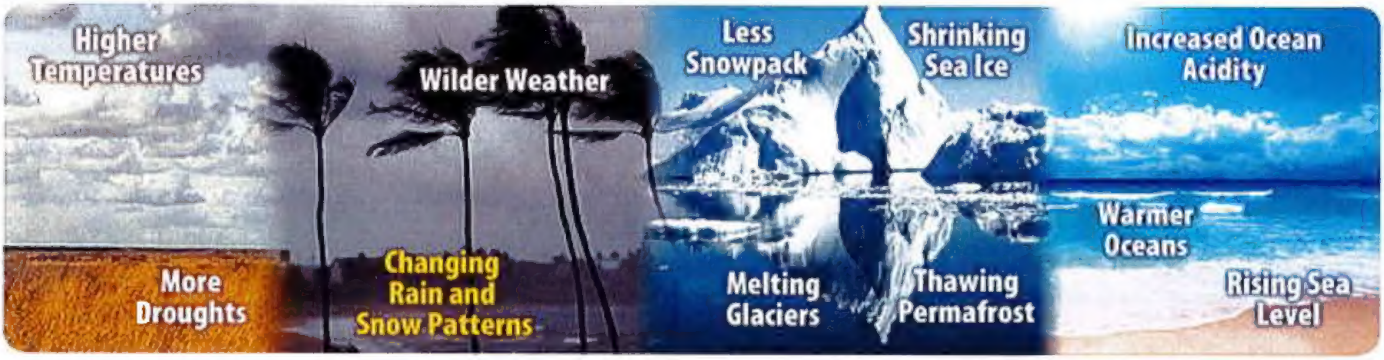
> "Climate change presents an unparalleled challenge. The world's leading scientist's report that carbon emissions from human activities have begun to destabilize the Earth's climate. Human influences on climate, already apparent at the global and continental scales, are altering the social, environmental and economic systems we rely upon."
>
> -IPCC (2013)

While the cause of climate change is a heavily debated topic, the scientific consensus is that climate change is occurring. According to the USEPA, the earth's *average* temperature rose by 1.4 degrees Fahrenheit (°F) over the past century and is projected to rise another 2 to 11.5°F over the next century (USEPA 2014b). Some regions may have even higher temperature fluctuations.

The National Aeronautics and Space Administration (NASA) has recorded more rapid temperature increases near the north and south poles, which is referred to as arctic amplification. Arctic amplification leads to melting glaciers and sea level rise, producing loss of arctic habitat, potential loss of coastal lands and intrusion of saline water on freshwater supplies.

Changes in precipitation patterns have been documented throughout the U.S. and world. While increases in precipitation can inundate municipal waste water treatments plants and flood roadways, decreases in precipitation can hinder groundwater recharge and reduce snowfall and snowpack.

Figure 1: Effects of Climate Change



(USEPA 2014a)

Climate change is believed to cause extreme weather events. Government scientists at the National Oceanic and Atmospheric Administration (NOAA) believe that climate change has increased the probability of longer and more intense heat waves which would exacerbate the occurrence of wildfires (WRI 2012). It is also thought that increased air and ocean temperatures could alter flow patterns resulting in more extreme weather events. The Australian government attributes rainfall 300-400 % higher than normal in the summer of 2010-2011 and one of the largest cyclones in record keeping history to climate change (Australian Government Great Barrier Reef Marine Park Authority 2011). Additionally, ocean acidification is attributed to increased carbon uptake by the oceans. Oceans absorb CO_2 from the atmosphere which then bonds with sea water decreasing the ocean's pH. This decrease in pH (increase in acidity), "...has been shown to significantly reduce the ability of reef-building corals to produce their skeletons." (NOAA PMEL Carbon Program 2015).

> "Observations show that changes are occurring in the amount, intensity, frequency and type of precipitation. These aspects of precipitation generally exhibit large natural variability...[however] Pronounced long-term trends from 1900 to 2005 have been observed in precipitation amount in some places: significantly wetter in eastern North and South America, northern Europe and northern and central Asia, but drier in the Sahel, southern Africa, the Mediterranean and southern Asia.
> -IPCC (2007)

Finally, glacial decline provides compelling evidence of the effects of increasing greenhouse gas (GHG) emissions on climate change. Melting glaciers and rising sea levels have been documented: "The Australian National Tidal Centre reports that sea levels in Kiribati have averaged a rise of 3.7 millimeters a year since 1972" (Office of the President Republic of Kiribati 2015). Below are two images of the Muir Glacier in Glacier Bay National Park in Alaska. The photo on the left was taken on August 13, 1941 and the photo on the right was taken on August 31, 2004.

Figure 2: Observed Changes of the Muir Glacier

(Source: U.S. Global Change Research Program)

The Climate Change Debate

The cause of climate change is debated between those who believe it is anthropogenic (the result of human activity), and those who believe that the changing climate is a natural phenomenon (a normal range of earth's cycles). The Intergovernmental Panel on Climate Change (IPCC) (established by the United Nations Environment Programme), the World Meteorological Organization (WMO), USEPA, NOAA and NASA support the scientific evidence that climate change is anthropogenic.

Scientists have used carbon dating of ice cores and have analyzed tree rings, glacier lengths, pollen remains and ocean sediments to piece together a picture of Earth's climate dating back hundreds of thousands of years (NRC 2010). This data shows that while some variability in climate is natural, in general, climate changes prior to the industrial revolution can be explained by natural causes such as volcanic eruptions and changes in solar energy (NRC 2010). Climate change in the post Industrial Revolution (1750s) era is attributed to the emission of CO_2 and other GHGs generated by humans. The primary human activity affecting the amount and rate of climate change is GHG emissions from the burning of fossil fuels (USEPA 2014c).

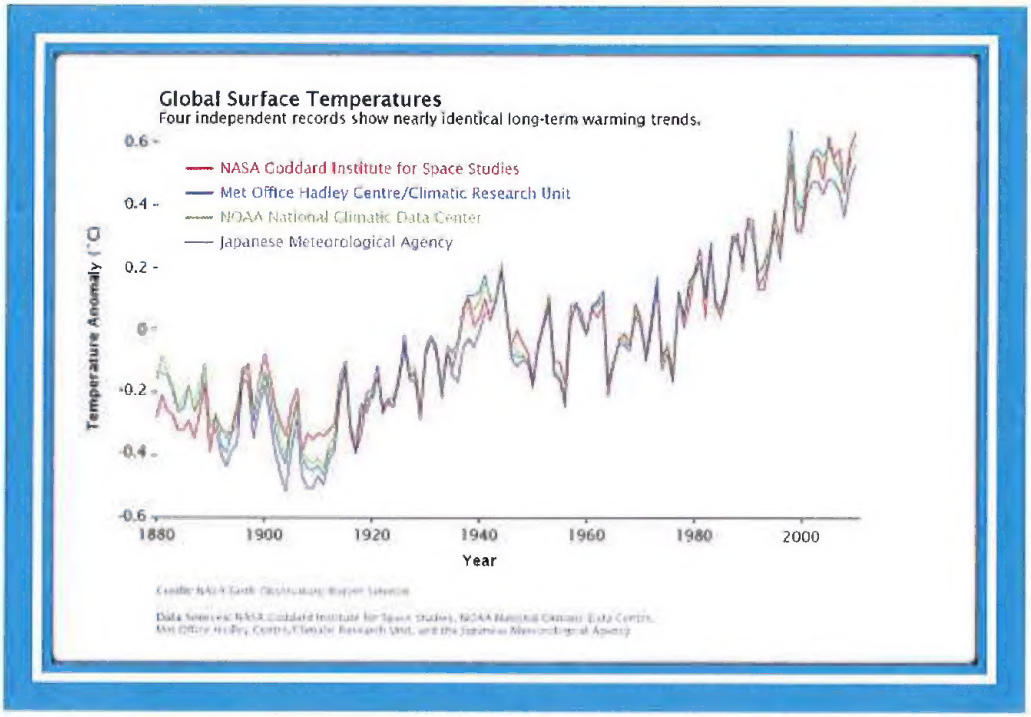
Climate Change Impacts

Whether small or large, every change in climate has some impact on cities and their inhabitants. Figure 2 graphically documents the impact of the ongoing California drought on the water level and corresponding water supplies of Millerton Lake just north of the City of Reedley. Because of this drought, the City of Reedley is required by the State of California to reduce monthly water consumption by 24%. To best equip its residents the City of Reedley publishes City-wide water consumption on its website. Air temperature increase, referred to as global warming, is one of the most well-known results of climate change. Figure 3 shows data collected by four independent institutions that operate global surface temperature monitoring stations. Despite subtle discrepancies, the trend documents a gradual increase in global surface temperatures. Impacts from rising temperatures range from personal, with increased utility bills for cooling costs, to universal with changes in seasons and climate zones.

Figure 2: Millerton Lake, Friant, CA on May 6, 2015

(The Atlantic 2015)

Figure 3: Global Surface Temperatures



Climate Change Risks Specific to the City of Reedley

Referred to as "The World's Fruit Basket," the City of Reedley's economy is predominantly agricultural production and agriculturally-oriented industry. Reedley leads the nation in the shipping of fresh fruit. Reedley produces fruits, vegetables, nuts, grains and cotton, and is home to thirty fruit and vegetable packing and cold storage facilities and related manufacturing industries.

Temperature rise provides many direct threats to the local agriculture economy (Figure 4). Climate change poses a threat to Reedley's crop production rates, pest control and water supplies. As climate variables like temperature, precipitation and soil moisture content change, insects, plant diseases and invasive weeds may be able to invade previously uninhabitable areas (U.C. Davis 2015). According to NASA, ambient temperatures in California rose nearly two degrees Fahrenheit during the second half of the 20th Century (NASA 2007). Based on observations from nearly 331 weather stations between 1950 and 2000, smaller increases measured in rural areas reflect the rise in greenhouse gas concentrations. Larger increases in and around urban areas – the "heat island effect" -- are the result of growing population and associated urban land uses.

Figure 4: California Temperatures on Rise

(NASA 2007)

Not only do increased ambient temperatures impact variables like crop production rates and growing/harvest seasons, global climate change threatens to disrupt the state's freshwater supply, which is heavily dependent on snowpack and snowmelt from the Sierra Nevada Mountains. Increased temperatures inhibit snowfall and decrease the duration of snowpack by causing snow to melt earlier than usual. Mountain snowpack provides as much as one third of the State's freshwater supply during spring and summer when snow accumulated during winter months melts and is slowly released (DWR 2015).

Fresh water from the Kings River and tributary streams provide many benefits. Fresh water supports natural wetlands, provides recreational space for citizens, supplies water to municipal, industrial and agriculture operations and contributes to ground water recharge (Webber 2007). Any decrease in surface water will disrupt these beneficial uses.

Historically, Reedley provides all domestic water through groundwater extraction. Groundwater is naturally replenished by rainfall and snow melt. Reedley has an annual average rainfall of 10.95 inches (Western Regional Climate Center 2010). With the State of California in its fourth consecutive summer of drought resulting from record low rainfall and snowpack, stopping and possibly reversing GHG-induced climate change is vital for sustaining the City of Reedley. This decrease in available statewide water supplies directly impacts the City of Reedley and its economy.

Farming operations are adapting to the effects of climate change on water supply. *The Reedley Exponent* reported that farmers are pumping groundwater to replace missing surface water supplies and irrigating earlier in the season than usual. Reducing irrigation is not a viable option for many crops. A local fruit grower reported that curtailing irrigation results in smaller fruit, which returns less profit as consumers prefer larger fruit (The Reedley Exponent 2014).

According to the California Energy Commission (CEC), altered temperature and precipitation patterns are anticipated to change global fire activity (CEC 2012). Intensifying droughts, wildfire risks and prolonged heat events threatens air quality with increased incidence of wind-blown dust and emissions from fires (American Lung Association 2015). This would exacerbate the State's non-attainment status with California Ambient Air Quality Standards (CAAQS) for particulate matter and the National Ambient Air Quality Standards (NAAQS for particulate matter 2.5 microns or smaller ($PM_{2.5}$) (SJVAPCD 2012). High air pollution levels have both short and long term effects: immediate health problems consist of aggravated cardiovascular and respiratory illness while long-term exposures can shorten lifespans (Spare the Air 2015).

Climate Change Policy

AB 32 (California Assembly Bill 32)

AB 32, formally known as the Global Warming Solutions Act of 2006, requires the State of California to reduce its GHG emissions to 1990 levels by 2020. This reduction equates to approximately 15 % below emissions expected under a "business as usual" (BAU) scenario. In December 2007, the California Air Resources Board (CARB) identified the 2020 limit, equal to statewide emissions in 1990, of 427 million metric tons of carbon dioxide equivalent (MMTCO2e) gases. AB 32 also requires CARB to develop a policy plan for reaching emissions reduction goals and to adopt and enforce regulations to implement the plan.

The resulting AB 32 Scoping Plan was adopted by CARB in December 2008. Among the many strategies articulated, it encourages local governments to reduce emissions in their jurisdictions by a degree commensurate with state goals. Given that identifying 1990 emissions levels can be difficult for some local governments, a reduction of approximately 15 % below "current" levels (this language was used in 2008) is given as a rough equivalency. However, AB 32 stopped short of setting mandatory targets for local government compliance. The state has not set a GHG air quality significance threshold, though it has the authority to do so through CARB. California's 35 air districts, which operate independent of the state and CARB, are responsible for enforcing state and federal air pollution reduction laws in their

jurisdiction, including AB 32. The air districts can establish threshold levels that are enforceable within their jurisdiction, and some air districts have set significance thresholds which trigger mitigation requirements. These thresholds vary by region.

In addition, AB 32 identifies the following GHG emission reduction strategies that can be impacted by local governance:

- Develop a California cap-and-trade program.
- Expand energy efficiency programs.
- Establish and seek to achieve reduction targets for transportation-related GHG emissions.
- Expand the use of green building practices.
- Increase waste diversion, composting, and commercial recycling toward a goal of zero-waste.
- Continue water efficiency programs and use cleaner energy sources to move and treat water.
- Reduce methane emissions at landfills.
- Preserve forests that sequester CO_2.

Important steps that have already been taken by the state include mandating stronger vehicle emissions standards (AB 1493, 2002), establishing a low-carbon fuel standard (EO # S-01-07, 2007), mandating a climate adaptation plan for the state (S-EO # 13-08, 2008), establishing a Green Collar Job Council, and establishing a renewable energy portfolio standard for power generation or purchase in the state. The state also has made a number of legislative and regulatory changes that have significant implications for local governments. According to CARB (CARB 2014), the following gases and compounds are covered under AB 32:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_20)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF_6)
- Nitrogen trifluoride (NF_3)

SB 97 (California Senate Bill 97)

SB 97 (2007) requires the Office of Planning and Research to maintain GHG planning guidelines for the California Environmental Quality Act (CEQA). In addition, CARB is tasked with creating energy-use and transportation thresholds for CEQA reviews which, if exceeded, would require local governments to account for GHG emissions when reviewing project applications.

CEQA

The California Environmental Quality Act requires California public agencies to evaluate the environmental impacts of its discretionary actions, development plans and projects in their jurisdictions. Pursuant to law, the state Office of Planning and Research updated CEQA guidelines to require analysis of climate change in CEQA documents, which came into effect in March 2010. Many jurisdictions are finding that climate change impacts from local government activities are "significant" under CEQA, and are identifying emissions reductions targets and Climate Action Plans (International Council for Local

Environmental Initiatives for Sustainability USA (ICLEI) Milestones Two and Three) as mitigation measures to reduce climate change impacts.

The California Attorney General's Office provides guidance on when to prepare a Climate Action Plan if the local government intends it to serve as its primary CEQA mitigation strategy for its General Plan:

> "If a city or county intends to rely on a Climate Action Plan as a centerpiece of its mitigation strategy, it should prepare the Climate Action Plan at the same time as its general plan update and EIR (Environmental Impact Report). This is consistent with CEQA's mandate that a lead agency must conduct environmental review at the earliest stages in the planning process and that it not defer mitigation. In addition, we strongly urge agencies to incorporate any Climate Action Plans into their general plans to ensure that their provisions are applied to every relevant project." (California Attorney General's Office 2011).

Furthermore, a local government may elect to incorporate GHG-related mitigation measures into its General Plan and fulfill CEQA through a fully integrated plan rather than separate efforts. The Natural Resources Agency added a new provision, Section 15183.5(b) to the CEQA Guidelines that became effective in March 2010, which provides a framework for GHG emissions reduction plans. An adequate plan must:

- Quantify GHG emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;
- Establish a level, based on substantial evidence, below which the contribution of GHGs from activities covered by the plan would not be cumulatively considerable;
- Identify and analyze the GHG emissions resulting from actions or categories of actions anticipated within the geographic area;
- Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis would collectively achieve the specified emission level;
- Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels; and
- Be adopted in public process following environmental review. (Association of Environmental Professionals 2014)

> "The accumulation of greenhouse gases in the atmosphere over time is likely to lead to dangerous climate change in the coming decades. Since a key purpose of CEQA is to maintain the quality of California's environment, both now and into the future, reducing the risk of dangerous climate change is an important objective under CEQA."
>
> -The Governor's Office of Planning and Research (2011)

The CEQA Guidelines now require lead agencies to assess GHG impacts; lead agencies must consider the extent a project complies with a statewide, regional or local climate action plan in order to assess "significance" (OPR 2011). The guidance, however, does not offer a guaranteed safe harbor for such projects. Finally, a local government may claim exemption from CEQA through a Categorical Exemption, assuming that the criteria for exemption are met (CA DOT 2014).

State Renewable Energy Programs

California has the most aggressive Renewable Portfolio Standard (RPS) in the nation, requiring 20 % renewable procurement by 2010. The Governor established an even more ambitious target through executive order with the Renewable Electricity Standard (RES).[1] Additionally, the state promotes solar uptake in the private sector with the California Solar Initiative (CSI) regulated by the California Public Utility Commission's (CPUC) CSI proceedings.

AB 811 (California Assembly Bill 811)

AB 811 (2007) authorizes all local governments in California, if they so choose, to establish special districts that can be used to finance energy efficiency, solar, or other renewable energy improvements to homes and businesses in their jurisdiction. As a result of opposition by Fannie Mae and Freddie Mac, federal regulators have effectively put most of the local programs dealing with residential properties on hold. It may take additional federal legislation to get residential programs fully back on track, although programs designed for commercial properties face no similar roadblocks. A handful of programs in California are continuing but at the time of publication, uncertainty remains.

SB 375 (California Senate Bill 375)

SB 375 (2008) revises the process of regional transportation planning by metropolitan planning organizations (MPOs), which are governed by elected officials from local jurisdictions. The statute calls on CARB to establish regional transportation-related GHG targets and requires MPOs to develop a regional "Sustainable Communities Strategy" (SCS) of land use, housing, and transportation policies that will move the region towards its GHG target, or an "Alternative Planning Strategy" (APS) if the SCS cannot achieve the GHG reduction goals. The statute stipulates that transportation investments must be consistent with the Sustainable Communities Strategy and provides CEQA streamlining for local development projects that are consistent with the Strategy.

City of Reedley Government Operations GHG Emissions Inventory

The City of Reedley, in collaboration with Pacific Gas and Electric Company, the Economic Development Corporation serving Fresno County, the City of Fresno, and International Council for Local Environmental Initiatives for Sustainability USA, compiled the *City of Reedley Government Operations Greenhouse Gas Emissions Inventory 2005 Baseline Year Narrative Report* (City of Reedley 2012). This document classified emissions in accordance with the three "scopes" established by the Carbon Disclosure Project (CDP):

- **Scope 1 GHG emissions** are direct emissions from sources owned or controlled by the reporting agency. Scope 1 sources in the City's 2005 Baseline Narrative include stationary combustion sources that produce electricity, steam, heat and power equipment; mobile combustion of fossil fuels (city-owned vehicle fleets); process emissions from physical or chemical processing; fugitive emissions that result from productions, processing, transmissions, storage and use of fuels; leaked refrigerants; and other sources (Reedley 2012).
- **Scope 2 GHG emissions** are defined by the CDP as emissions that do not physically occur from within the organization's reporting boundary. Scope 2 emissions are the result of the organization's consumption of electricity, heat, cooling or steam generated outside of the

[1] Executive Order S-21-09 authorizes CARB to adopt a regulation requiring that all retail sellers of electricity serve 33 % of their load with renewable energy by 2020.

reporting boundary. The most common example of Scope 2 emissions is purchased electricity. The 2005 Baseline narrative includes purchased or acquired electricity, steam, heat and cooling (Reedley 2012).

- **Scope 3 GHG emissions** are defined by the CDP as indirect emissions other than those covered in Scope 2. Scope 3 emissions are generated from sources that are not owned or controlled by an organization but occur as a result of its activities. Sources of Scope 3 emissions in the 2005 Baseline Narrative include mobile exhaust emissions from employee commutes, emissions resulting from employee business travel, and emissions resulting from the decomposition of government-generated solid waste (Reedley 2012).

Table 1: Reedley Municipal Emissions by Scope

Scope 1	Scope 2	Scope 3
Fuel consumed at facilities	Purchased electricity consumed by facilities	Solid waste generated by government operations
Fuel consumed by vehicle fleet and mobile equipment	Purchased electricity consumed by electric vehicles	Fuel consumed by vehicles during employee commuting
Fuel consumed to generate electricity	Purchased steam	
Leaked refrigerants from facilities and vehicles	Purchased cooling (chilled water)	
Leaked / deployed fire suppressants		
Solid waste in government landfills		
Wastewater decomposition and treatment at a municipal wastewater treatment plant		

(Source: Reedley 2012, Table 4)

As shown in Table 2, the majority of the City's emissions in 2005 were Scope 2 GHG emissions from the consumption of purchased electricity outside the City's boundary. Scope 1 emissions are the second largest source of GHGs that are primarily from fuel consumption at facilities and by City-owned mobile fleets, and the municipal wastewater treatment plant.

Table 2: Reedley Municipal Emissions Quantified by Scope

Total Emissions	CO_2e	CO_2	CH_4	N_2O	HFC 134a	R-401A Blend	R-410A Blend
Scope 1	786.99	632.45	0.01	0.00	0.03	0.02	0.06
Scope 2	1,310.49	1,146.62	0.07	0.03	0.00	0.00	0.00
Scope 3	262.30	254.76	0.02	0.02	0.00	0.00	0.00

(Source: Reedley 2012, Table 1)

Reduction Targets

The City of Reedley is committed to ensuring their sustainability. As such, they have adopted a series of GHG reduction benchmarks for achieving their ultimate goal of reducing emissions to 80 % below 2005 levels by 2080:

- Near-term: Reduce emissions to 15 % below 2005 levels by 2020
- Mid-term: Reduce emissions to 50 % below 2005 levels by 2050
- Far-term: Reduce emissions to 80 % below 2005 levels by 2080

While the City has already met its near-term goal, growth presents a real challenge to meeting future goals. Prior to the adoption of the General Plan 2030, the city limits encompassed 3,133 acres with 3,954 acres in its sphere of influence (SOI). In the General Plan 2030, the City of Reedley expanded its SOI by 2,860 acres, increasing the City and its SOI to 7,087acres (City of Reedley, Environmentally Superior Alternative 3, adopted February 25, 2014). This expansion, coupled with anticipated growth present serious challenges for the City meeting both the mid and far term goals.

Additionally, in an effort to more effectively and accurately track progress the City has committed to updating its GHG inventory every three to five years.

Local Actions Being Taken

The City of Reedley surpassed their 2020 goal of a 15 % reduction from 2005 GHG emissions and is on its way to achieving their mid-term goal of a 50 % reduction by 2050 (Table 3). The City has already reduced annual GHG emissions by 23 % below 2005 levels by: 1) retrofitting city-owned building and parking lot lighting; 2) installing solar energy systems at four municipal operations; and 3) replacing three conventional municipal garbage trucks with compressed natural gas (CNG) powered trucks. As a result of these efforts, CO_2e emissions are projected to be reduced from 2,359 MTCO2e in 2005 to 1,976 MTCO2e in 2015.

Emission reductions were calculated using the following methodologies:

The city reported a 40 % reduction in the consumption of electricity resulting from their lighting retrofit program. Emission reductions were calculated by reducing the total MTCO2e from electricity for buildings and other facilities reported in Table 6 of the City's 2005 Baseline Narrative Report by 40 % (Reedley 2012).

Emission reductions from the installation of solar energy systems are projected emissions that were estimated by annualizing actual solar energy production data reported on the City's website for each facility's system. Electricity generated by each facility's solar system between January 1, 2015 and April 29, 2015 was reported in kilowatt hours (kWh) and multiplied by three to represent a year's worth of solar energy production data.[2] The projected annual kWh production was then multiplied by the appropriate emission factors to calculate the total MTCO2e that would have been produced by the consumption of conventionally generated electricity. Annualized MTCO2e was subtracted from MTCO2e reported for building electrical consumption in Table 6 of the 2005 Baseline Narrative to provide the total reduction in MTCO2e.

Emissions reductions from the replacement of the three diesel-fueled municipal garbage trucks with CNG-fueled garbage trucks were calculated based on annual mileage provided by the City of Reedley. An estimated 2.8 miles per gallon (mpg) was assumed for diesel-fueled garbage trucks and 2.51 miles

[2] This was the most data available at the time of this CAP.

per diesel gallon equivalent (mpDGE) was assumed for CNG-fueled garbage trucks (Johnson 2010).[3] MTCO2e from diesel-fueled trucks was calculated by dividing annual miles traveled by mpg to determine how many gallons of diesel were consumed per vehicle. The estimated gallons per year consumption was then multiplied by emission factors provided by the USEPA to determine an annual MTCO2e per diesel-fueled truck (USEPA 2014d).

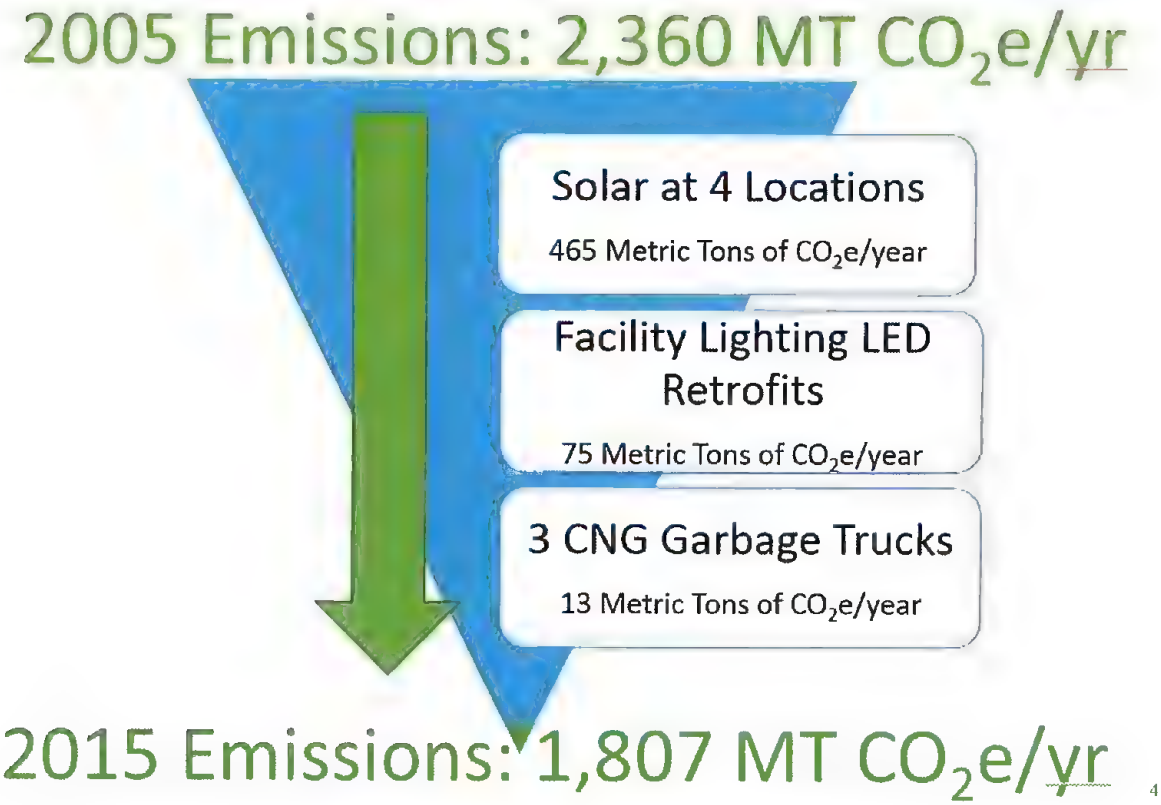
MTCO2e from CNG-fueled trucks was calculated by dividing annual miles traveled per truck by estimated mpDGE and multiplying it by the conversion factor of 143.94 standard cubic feet (scf) per diesel gallon equivalent (DGE). This provides annual CNG consumption in scf/year. Annual CNG consumption in scf/year was then multiplied by emission factors provided by the EPA to determine an annual MTCO2e per CNG-fueled truck (USEPA 2014d).

The reduction of MTCO2e from the replacement of three diesel-fueled municipal garbage trucks with CNG-fueled municipal garbage trucks was calculated by subtracting annual MTCO2e for each CNG-fueled truck from the annual MTCO2e for the diesel-fueled truck that it replaced.

Additionally, Reedley's water sustainability measures are reducing resident-generated GHGs by restricting the amount of water consumed by residents for landscape irrigation. This decrease in water consumption reduces the amount of energy required to move water through the city with less water is being used. These decreases are not quantified in this CAP however, because although the reductions were prompted by the City, they are implemented by residents.

On May 26, 2015 the City of Reedley adopted Urgency Ordinance Number 2015-02 that amended the water conservation section of the existing code and established the City of Reedley at Level 2 Water Conservation Restrictions. The ordinance, applicable to city property owners, details a schedule that allows residents to water two times per week during the summer (April 2 to October 30) and once a week during the winter (November 1 to April 1). There are additional restrictions preventing the waste of potable water.

[3] Emissions factors used in the calculation of GHG emission reductions were produced by the USEPA in their document, *Emission Factors for Greenhouse Gas Inventories* (USEPA 2014d).



[4]

Table 3: Emission Reduction Quantification

Reduction	2005 CO2E Baseline (MTCO2e)	2015 Annual Operational (MTCO2e)	Annual CO2e Reduction (MTCO2e)
City Owned Facility Lighting	186.42	111.85	74.57
Waste Water Treatment Plant	432.11	35.03	397.08
City Hall, Royal Valley Building & Community Center Combined	186.42	118.30	68.12
Diesel truck # 222 (Replaced by CNG truck #232)	40.74	36.04	4.71
Diesel truck # 223 (Replaced by CNG truck #233)	36.93	32.27	4.66
Front Loader (Replaced by CNG truck #234)	26.16	22.90	3.26
TOTAL	908.78	356.39	552.39

(Insight Environmental Consultants 2015)

[4] 2005 annual MTCO2e is based on summing emissions reported for Scopes 1, 2 and 3 in Table 1: Overall Emissions by Scope from the 2005 Baseline Narrative Report (Reedley 2012).

The Economics of Climate Change and the City of Reedley

Climate change presents many challenges. Most notably, climate change presents economic threats to agriculture, energy and transportation. As discussed above, increased temperatures and decreased precipitation impacts growing and harvest seasons and crop yields.

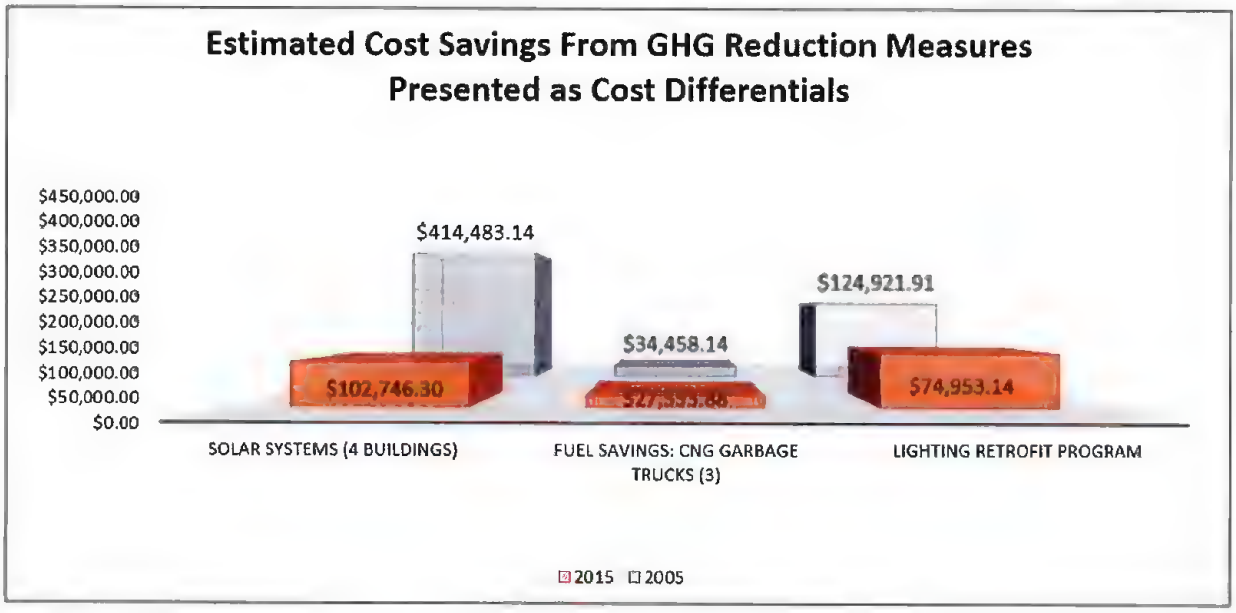
Additionally, climate change is anticipated to increase demand on the country's energy infrastructure with severe weather events disrupting normal operations. According to the U.S. Department of Energy (DOE), eight of the ten most destructive hurricanes on record occurred in the last decade (U.S. DOE 2015). Disruption of energy would directly impact Reedley's agriculture processing and storage operations.

Extreme weather events impact transportation systems and agriculture. In Reedley, flooding could damage roadways, impair the safe movement of people and goods, obstruct crop export operations, and wash away precious top soil.

In light of these challenges, the City of Reedley recognizes that Climate Change also presents opportunities. The City saves an estimated $368,609.00 annually based on assumptions and calculation methodologies above (Figure 5).[5] Reedley achieved a 23 % reduction in CO_2e emissions through:

1) Retrofitting lights in all City owned Buildings and parking lots;
2) Adding solar panels to four municipal buildings; and
3) Replacing three diesel trucks with CNG powered trucks.

Figure 5: Reedley GHG Reduction Measures Cost Savings



(Insight Environmental Consultants 2015)

[5] This cost savings does not included additional cost to implement reduction measures such as the purchase of new garbage trucks.

Cost savings were estimated as follows:

1) Lighting retrofits: The City attributed a 40 % reduction in total electricity consumed by city owned building and parking lot lighting to their lighting retrofit program. Cost savings were calculated by multiplying the reduction of MTCO2e by the cost per MTCO2e used in the 2005 Baseline Narrative Report.[6]

2) Installed Solar systems: Cost savings from solar systems installed at the Waste Water Treatment Plant, City Hall, Royal Valley Building and Community Center were estimated by multiplying 2005 MTCO2e and the reduction of MTCO2e (resulting from solar-produced energy) by the cost per MTCO2e used in the 2005 Baseline Narrative.[7] Cost savings were calculated by subtracting the cost saved by solar energy production from 2005 costs (calculated using the methodology described above).

3) CNG-fueled trucks: Fuel savings were calculated by subtracting CNG annual fuel costs from diesel annual fuel costs. The estimated annual consumption of diesel fuel in gallons was multiplied by the current cost per gallon of diesel. Estimated annual consumption of CNG in gallons per DGE was multiplied by the current cost of CNG/DGE (CNG Now! 2015).

Guide for Future Progress

By implementing the strategic measures detailed above, the City of Reedley has not only achieved, but also surpassed its near-term goal to reduce emissions by 15 % of 2005 levels by 2020: To date, the City of Reedley has successfully reduced GHG emissions from municipal operations 23 % below 2005 levels.

As much as this may be a laudable effort, the City is looking forward to the mid-term goal of reducing emissions by 50 % below 2005 levels by 2030 and the ultimate goal of reducing GHG emissions 80 % below 2005 levels by 2050. The City recognizes the many challenges that lie ahead and is committed to begin immediately working toward the 2030 emission reduction goals and levels. Achieving these goals will be no simple task for the City given the efficiency of current operations, the financial commitments necessary for achieving reductions, and anticipated growth of the City's population and municipal operations. The City has a commitment to fostering business growth which can sometimes make it more difficult to achieve these emissions reductions goals. Despite the challenges that lie ahead, the City of Reedley is committed to the 2030 emission reduction goals and looks to the security that the sustainability efforts will provide to municipal operations, city residents and city businesses.

To ensure that future residential and commercial developments within City-limits also achieve the City's GHG reduction goals, the City has compiled a Greenhouse Gas Reduction Compliance Checklist to enable new, infill, re-use and rehabilitation projects within City-limits to "self-certify" that their project meets the required 20 % GHG emission reduction (See Appendix A). Project applicants must demonstrate through completion of this checklist (or other City-approved quantification), how projects will comply with this 20 % GHG reduction. This includes GHG reduction measures related to a decrease in vehicle trips/miles; construction materials such as type of insulation, windows, cool roof, etc.; use of solar energy systems; use of passive lighting and location of landscaping (for shading); use of water reduction

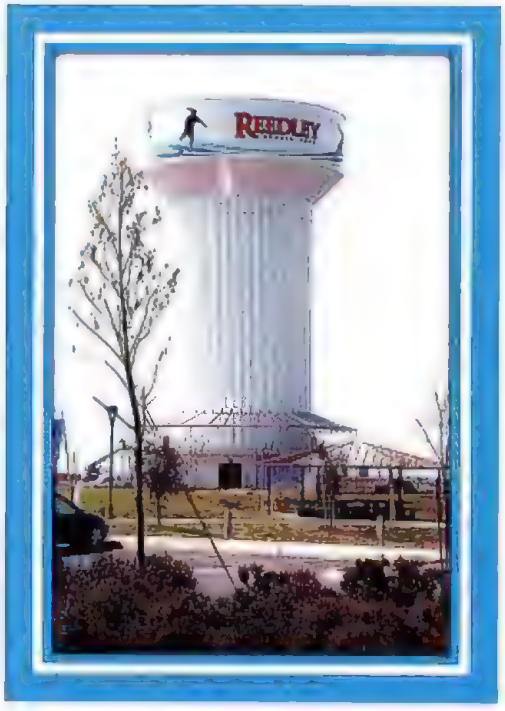
[6] The lowest cost per MTCO2e derived from the data in Table 8: Public Lighting Emissions by Subsector in the *2005 City of Reedley Government Operations Greenhouse Gas Emissions Inventory Report* (Reedley 2012).

[7] The lowest cost per MTCO2e derived from the data in Table 8: Public Lighting Emissions by Subsector in the *2005 City of Reedley Government Operations Greenhouse Gas Emissions Inventory Report* (Reedley 2012).

measures, etc. As technology dictates, the checklist may be updated to facilitate more efficient reduction measures.

Additionally, the City has begun several programs, projects and/or facilitated operational changes that will further reduce GHG emissions. It is recommended that the following reduction measures are quantified in the next CAP update:

1. Calculate CO_2 accumulation from Kings River Reforestation Project: In 2012, 150 young native trees were planted as part of the Kings River Reforestation Project. These trees are hand irrigated on an as-needed basis by volunteers. Emission reductions from these trees may be calculated after a 20 year growing period, as recommend by the IPCC. It is estimated that in 2032 the trees will sequester 4.8 MTCO2e annually.
2. Expand the current lighting retrofit program to include Traffic Signals: LED traffic signals provide a 90 % reduction in energy usage and have a longer lifespan. Additionally, LED traffic lights require less maintenance with lower rates of replacement, which can yield significant cost savings from bulb replacement and labor costs. It is estimated that by replacing traffic signals with LED lights the City of Reedley would reduce annual CO_2 emissions by 16.5 metric tons and save an estimated $11,323.00 electricity costs.[8,9]
3. Hybrid / Electric Municipal Vehicle Record Keeping: It is recommended that the City develop and maintain vehicle mileage records so reductions of GHGs can be quantified as the City acquires a fleet of hybrid vehicles or electric carts that replace conventional fuel-fired vehicles.
4. Water Tower Energy Reductions: In September 2011, the City began construction of a new 170 foot high, 1.5 million gallon water tower, which was completed in late 2014. The tower (depicted on the right) was built with the purpose of increasing water pressure city-wide and more importantly, to provide the required water pressure and additional water storage for firefighting. It is equipped with energy efficient pumps that allow the City to pump water at night instead of during daytime peak energy hours. Eventually the tower will phase-out two water towers, known as the twin towers behind the Reedley Opera House. These older towers are not tall enough to provide the needed water pressure and only have a combined storage capacity of 100,000 gallons. After the twin towers are removed from service, it is recommended that the City quantify GHG emission reductions resulting from the new, more energy efficient water tower.



[8] Note: this cost savings does not account for the cost of LED light bulbs or the labor to replace existing bulbs.
[9] Cost savings are based on the data provided in Table 8 of the 2005 Baseline Narrative and do not account for potential increases in streetlights (Reedley 2012).

5. Modernized / Green Building Codes: The City of Reedley building codes are and will continue to evolve in order to ensure the efficiency and sustainability of local buildings. Emission reductions from windows and insulation with increased efficiency (etc.).

6. The City should establish a replacement policy and schedule to replace fleet vehicles and equipment with the most fuel efficient vehicles practical, including gasoline hybrid and alternative fuel or electric models (GPU, COSP 4.4.17, Pg. 115).

7. The City will adopt purchasing practices and standards to support reductions in GHG emissions, including preferences for energy-efficient office equipment, and the use of recycled materials and manufacturers that have implemented green management practices (GPU, COSP 4.4.22, Pg. 116).

8. The City will continue to work collaboratively to created partnerships with PACE program providers who offer a landowner alternative financing for renewable energy generation, energy and water efficiency improvements, similar to Figtree Financing, the California HERO Program and the YGRENE Program.

Conclusion

The City of Reedley acknowledges that Climate Change is occurring and presents many economic and environmental challenges for residents and local businesses. The City of Reedley has taken aggressive measures to mitigate impacts from municipal operations on GHGs and climate change and will continue to do so through the future update of this Climate Action Plan. Through the installation of solar systems, retrofitting lighting in municipal buildings and replacing three diesel garbage trucks with CNG trucks the City of Reedley has reduced GHGs by 23 % below 2005 levels while concurrently saving more than $300,000.00 annually in reduced fuel and electricity costs.[10] In addition, the City is requiring new, infill, re-use and rehabilitation projects within City-limits to demonstrate a 20 % GHG reduction in order to meet the 2030 near-term City-mandated reduction goal. The City of Reedley is taking the necessary steps to mitigate its impacts on the natural environment and is setting a strong example for cities of similar size and operation.

[10] This cost savings does not include the cost of implementation of reduction measures such as the cost of CNG trucks, solar panels or lights.

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Appendix A: Greenhouse Gas Reduction Compliance Checklist

City of Reedley - Community Development Department

1733 Ninth Street, Reedley, CA 93654

(559) 637-4200 Fax No. (559) 637-2139

Greenhouse Gas Reduction Compliance Checklist

The City of Reedley is required to reduce by 50% Greenhouse Gas (GHG) emissions in order to meet the State mandated 2030 near-term emission reduction goal. In order to maintain city-wide growth and attain this GHG reduction goal, the City is requiring that all new, in-fill, re-use and rehabilitation proposed projects meet a 20% reduction in GHG emissions. Below is a list of recommended measures and average reductions (in percentage). Project applicants must demonstrate through the completion of this checklist, how project's will comply with the 20% GHG reduction requirement. Alternative calculations and measures may be used upon approval. If a Project Applicant wishes to use an alternative calculation or measure supporting documentation must be submitted as an attachment to this checklist. A completed checklist is must be submitted to the Community Development Department at the time an application/s for

Applicant/Business Name:

Project Name:

Project Location:

Project Type (Commercial, Industrial or Residential):

GHG Reduction Measure	Average Reduction (%)	Is measure being utilized for this project? (Y/N)	Comments
Construction			
20% of construction materials are manufactured regionally	TBD*		
50-100% diversion of construction materials from waste materials generated during the project	TBD*		
Solar Systems			
Photovoltaic solar energy provides 20-49% of power needs (annual average)	17%		(_____KW/Annual)
Photovoltaic solar energy provides 50-74% of power needs (annual average)	31%		(_____KW/Annual)

Photovoltaic solar energy provides 75-100% of power needs (annual average)	44%		(____KW/Annual)
Solar hot water heater (residential)	6%		
Solar hot water heater (commercial)	1.80%		
Insulation			
Enhanced insulation: rigid walls insulation R-13, roof/attic R-38	4.50%		
Greatly enhanced insulation: spray foam insulated walls R-15 or higher, roof/attic R-38 or higher	6.75%		
Windows			
Modestly enhanced window insulation: 0.4 U-Factor, 0.32 solar heat gain coefficient (SHGC)	6%		
Enhanced window insulation: 0.32 U-Factor, 0.25 SHGC	10%		
Greatly enhanced window insulation: 0.28 U-Factor, 0.22 SHGC	14%		
Cool Roof			
Cool Roof: Light-colored, high albedo roof	0.30%		
Lighting			
Passive lighting: Light Shelves and/or sunlights	3.75%		
Air Filtration & HVAC			
Sealed air ducts with a minimum insulation of (R-6)	9%		
Air Curtain and Automatic Door Combo (Commercial)	4%		
Air Curtain	1.50%		
Improved efficiency HVAC. A minimum SEER 14/65% AFUE or 8 HSPF	11%		
Water Efficiency			
Energy Star or better rated water heater	12%		
Low flow kitchen faucet	1%		
Low flow bathroom faucet	1%		
Low flow shower	1%		
Low flow toilet	1%		
Drip irrigation or low precipitation spray heads	0.20%		
Landscape with California native plants (50% to 100%)			
Graywater systems	1%		

Miscellaneous			
Install EV charging Station	0.11%		
Landscaping for Energy Efficiency: Plant shade trees on a buildings' south side	2%		
Land Use Based Trip and/or VMT Reduction			
Mixes of land uses that complement one another in a way that reduces the need for vehicle trips can greatly reduce GHG emissions. The percent reduction will be determined based upon a traffic impact study demonstrating trip reductions and/or reductions in vehicle miles traveled.	TBD*		
Having residential developments within walking and biking distance of local retail helps to reduce vehicle trips and/or vehicle miles traveled. The percent reduction will be determined based upon a traffic impact study demonstrating trip reductions and/or reductions in vehicle miles traveled.	TBD*		
Other Measures:	TBD*		
Other Measures:	TBD*		
Other Measures:	TBD*		

*TBD Project applicants must quantify and support this measure's GHG reductions.

Appendix B: City of Reedley Government Operations Greenhouse Gas Emissions Inventory: 2005 Baseline Year Narrative Report

City of Reedley

Government Operations

Greenhouse Gas Emissions Inventory

2005 Baseline Year Narrative Report

Supported by Pacific Gas and Electric Company
In Collaboration with the Economic Development Corporation serving Fresno County, the City of Fresno, and ICLEI-Local Governments for Sustainability USA

September 28, 2012

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ICLEI-Local Governments for Sustainability USA

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Executive Summary

City of Reedley Profile

The City of Reedley covers over 4.5 square miles and is west of the Sierra Nevada Mountains adjacent to the Kings River. The City of Reedley had an estimated population of 22,601 on January 1, 2005 and 23,341 on January 1, 2006. With 105 City employees in the year 2005, there was a ratio of approximately 5 employees per one thousand residents. The City of Reedley's total budget was $ 20,867,631 for fiscal year 2004-2005 and $ 26,985,985 for fiscal year 2005-2006.

The City of Reedley is located within Climate Zone 13,[1] according to the U.S. Department of Energy, and is characterized by Dry Semi-Arid environments. The City of Reedley records approximately 3,600 heating degree days[2] and 1,100 cooling degree days per year.[3]

The Purpose of Conducting an Inventory

The City of Reedley recognizes that the State of California has made greenhouse gas reductions a priority through the passage of AB 32, the Global Warming Solutions Act of 2006. It directed the California Air Resources Board, (ARB) to begin developing discrete early actions to reduce greenhouse gases statewide to 1990 emission levels. The state-created scoping plan indicates how these emission reductions will be achieved from significant greenhouse gas sources via regulations, market mechanisms, and other actions.

Each day, local governments operate buildings, vehicle fleets, streetlights, traffic signals, water systems, and wastewater treatment plants; local government employees consume resources commuting to work and generate solid waste which is sent for disposal. All of these activities directly or indirectly cause the release of carbon dioxide and other greenhouse gases into the atmosphere. This report presents the findings and methodology of a local government operations (LGO) greenhouse-gas emissions inventory for the City of Reedley. The inventory measures the greenhouse gas emissions resulting specifically from the City of Reedley's government operations, arranged by sector to facilitate detailed analysis of emissions sources. The inventory addresses where and what quantity of emissions are generated through various local

[1] Pacific Energy Center's Guide to: California Climate Zones, retrieved from http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zones_01-16.pdf

[2] Heating and Cooling Degree Days are a measurement designed to reflect demand for energy needed to heat or cool a facility, and are calculated as the difference between the average daily temperature for a region and a baseline temperature (usually 65° or 80° F). HDD value is the summation of degrees of the average temperature per day below 65° F for the year. CDD is the summation of degrees of the average temperature per day above 80° F for the year.

[3] NNDC Climate Data, retrieved from http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp

government activities. Through analysis of a local government's emissions profile, the City of Reedley can tailor strategies to achieve the most effective greenhouse gas emission reductions.

These emission-reduction strategies include promoting energy conservation and energy efficiency in buildings and operations, utilizing renewable energy sources where appropriate, recycling and waste reduction, and supporting alternative modes and types of transportation for employees. The benefits of these actions include lower energy bills, improved air quality, more efficient government operations, in addition to the mitigation of climate change impacts.

By conducting this inventory, the City of Reedley is developing its capacity to understand and comply with future regulations and requirements around climate change, and is working to improve government services in a smart and targeted way that will benefit all of the City of Reedley's residents.

Inventory Results

Local governments provide different services to their citizens, and the scale of the services (and thus the emissions) is highly dependent upon the size and purview of the local government. For these reasons, comparisons between local government totals should not be made without keen analysis of the basis for figures and the services provided.

The following figures summarize the results of the LGO greenhouse gas emissions inventory for the City of Reedley, by sector and source. As illustrated in Figure 1, the sector producing the most greenhouse gas emissions in the City of Reedley is the Vehicle Fleet sector at 28%, followed by the Water Transport sector at 22%. As shown in Figure 2, purchased electricity and gasoline are the sources with the greatest percentage of emissions (52% and 27% respectively). Table 1 delineates the different types of greenhouse gases (CO_2, CH_4, N_2O, etc.), which are assigned a standard metric of carbon dioxide equivalent (CO_2e), and then combined to describe the total emissions of the City of Reedley.

Figure 1: 2005 Government Operations CO_2e Emissions by Sector

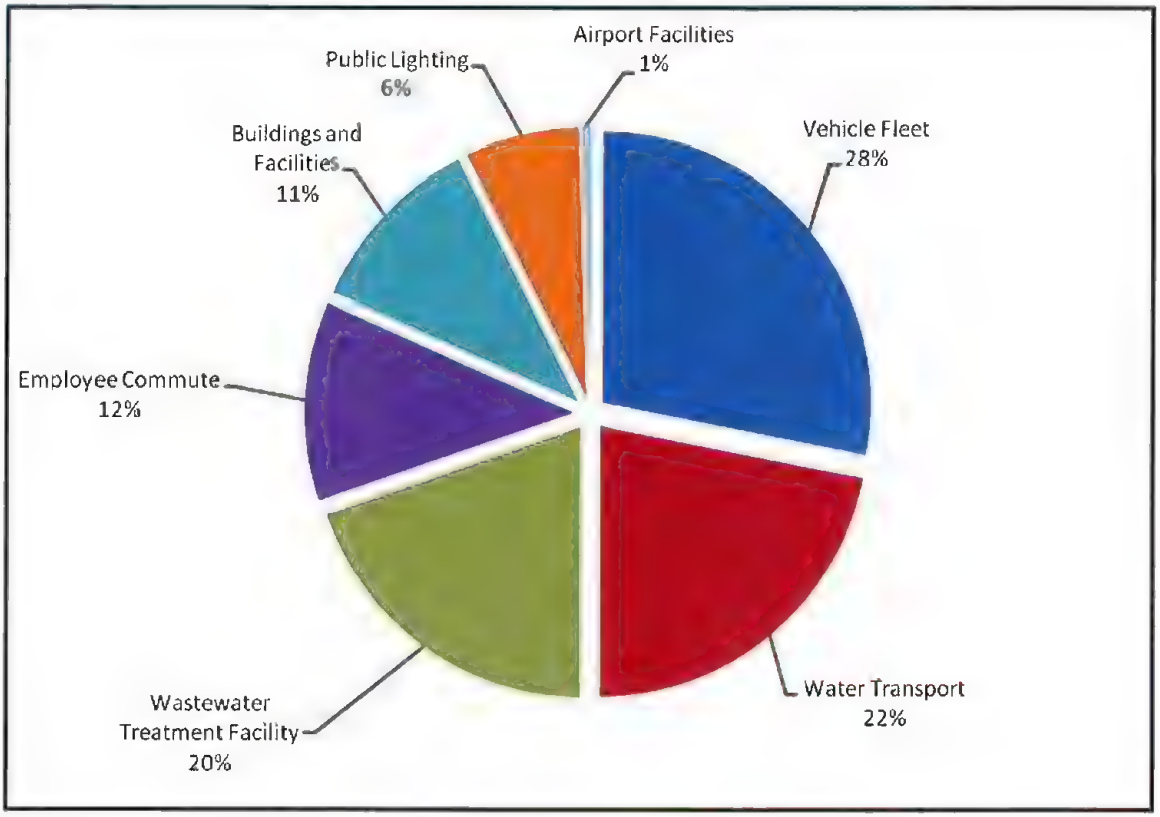

Figure 2: 2005 Government Operations CO_2e Emissions by Source

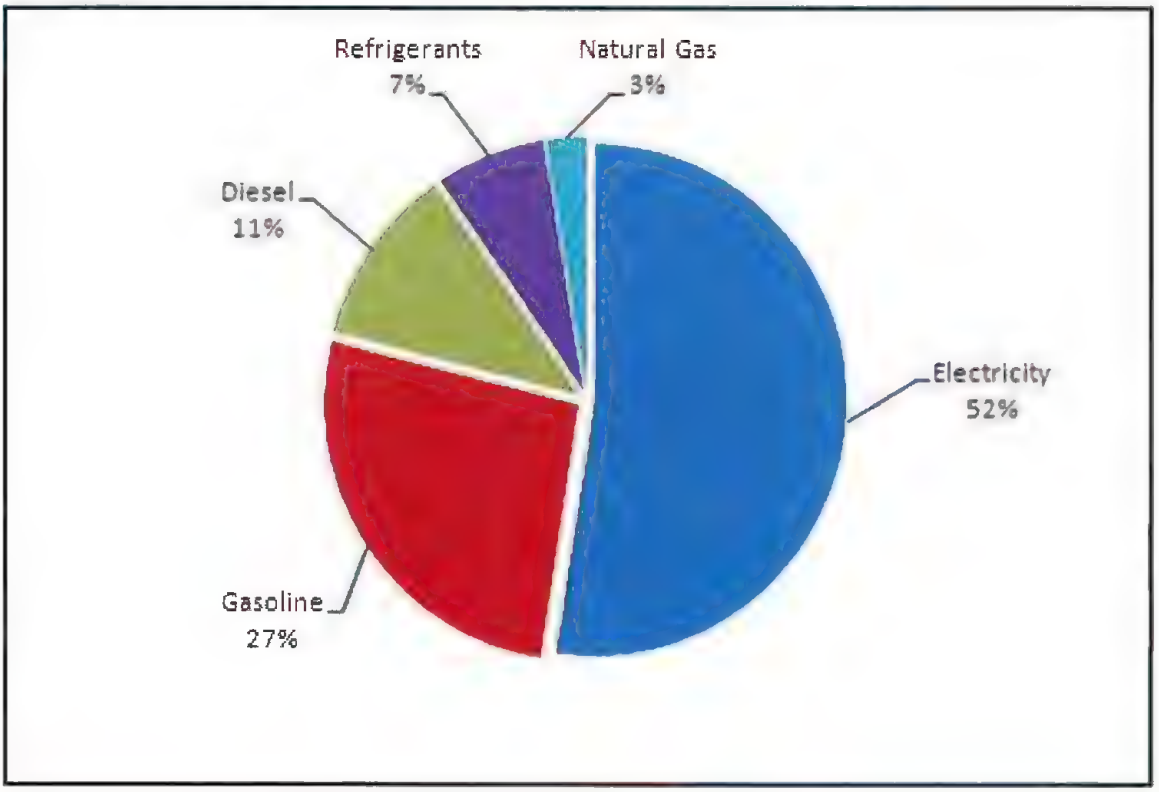

Table 1: Overall Emissions by Scope

Total Emissions	CO_2e	CO_2	CH_4	N_2O	HFC 134a	R-401A Blend	R-410A Blend
Scope 1	786.99	632.45	0.01	0.00	0.03	0.02	0.06
Scope 2	1,310.49	1,146.62	0.07	0.03	0.00	0.00	0.00
Scope 3	262.30	254.76	0.02	0.02	0.00	0.00	0.00

For more detail on the concepts of scopes, sources, and sectors, and to review more granular data produced through the inventory study, please refer to the full report on the following pages.

Regional and Local Context

Climate Change Mitigation Activities in California

Since 2005, the State of California has responded to growing concerns over the effects of climate change by adopting a comprehensive approach to addressing emissions in the public and private sectors. This approach was officially initiated with the passage of the Global Warming Solutions Act of 2006 (AB 32), which requires the state to reduce its greenhouse gas emissions to 1990 levels by 2020. The AB 32 Scoping Plan was developed to identify strategies for meeting the AB 32 goal, and was adopted by ARB in December 2008. Among many other strategies, it encourages local governments to reduce emissions in their jurisdictions by 15 percent below current levels by 2020. In addition, it identifies the following strategies that will impact local governance:

- Develop a California cap-and-trade program
- Expand energy efficiency programs
- Establish and seek to achieve reduction targets for transportation-related related greenhouse gas (GHG) emissions
- Expand the use of green building practices
- Increase waste diversion, composting, and commercial recycling toward zero-waste
- Continue water efficiency programs and use cleaner energy sources to move and treat water
- Reduce methane emissions at landfills
- Preserve forests that sequester carbon dioxide

Other measures taken by the state include mandating stronger vehicle emissions standards (AB 1493, 2002), establishing a low-carbon fuel standard (EO # S-01-07, 2007), mandating a climate adaptation plan for the state (S-EO # 13-08, 2008), establishing a Green Collar Job Council, and establishing a renewable energy portfolio standard for power generation or purchase in the state. The state also has made a number of legislative and regulatory changes that have significant implications for local governments:

- SB 97 (2007) required the Office of Planning and Research to create greenhouse gas planning guidelines for the California Environmental Quality Act (CEQA). In addition, ARB is tasked with creating energy-use and transportation thresholds in CEQA reviews, which may require local governments to account for greenhouse gas emissions when reviewing project applications.
- AB 811 (2007) authorizes all local governments in California to establish special districts that can be used to finance solar or other renewable energy improvements to homes and businesses in their jurisdiction.
- SB 375 (2008) revises the process of regional transportation planning by metropolitan planning organizations (MPOs), which are governed by elected officials from local jurisdictions. The statute calls on ARB to establish regional transportation-related GHG targets and requires the large MPOs to develop regional "Sustainable Communities Strategies" of land use, housing and transportation policies that will move the region towards its GHG target. The statute stipulates that transportation investments must be consistent with the Sustainable Communities Strategy and provides CEQA streamlining for local development projects that are consistent with the Strategy.

Pacific Gas and Electric Company Supported Inventory Project

With the administrative support of Pacific Gas and Electric Company (PG&E) and funding from California utility customers under the auspices of the California Public Utilities Commission, ICLEI - Local Governments for Sustainability ("ICLEI") was contracted to work with the EDC serving Fresno County and the City of Fresno to assist in the quantification of greenhouse gas emissions in the City of Reedley and the following other participating communities: the County of Fresno, the cities of Chowchilla, Clovis, Coalinga, Dinuba, Firebaugh, Fowler, Fresno, Huron, Kerman, Kingsburg, Madera, Mendota, Orange Cove, Parlier, Sanger, San Joaquin, and Selma. ICLEI is a nonprofit association of local governments that provides information, delivers training resources, organizes conferences, facilitates networking and city-to city exchanges, carries out research and pilot projects, and offers technical services and consultancy related to climate planning. Throughout 2012, ICLEI provided training and technical assistance to participating regional organizations, interns, and local government staff and facilitated the completion of this report.

Climate Change Mitigation Activities in the City of Reedley

The City of Reedley has already begun the process of emissions mitigation within City operations, which is also intended to result in higher energy efficiency and, therefore greater savings. To follow is a list of some of our greenhouse gas reduction efforts:

- Lighting retrofits at all City owned buildings/parking lots;
- The City purchased five electric golf carts. One is used at the our corporation yard and the other four are used at our Waste Water treatment plant;

- Applied for a hybrid vehicle grant through the San Joaquin Valley Air Pollution Control District. The application was for two hybrid vehicles and three electric vehicles;
- In the process of procuring three CNG powered garbage trucks to replace diesel powered trucks;
- Received a grant from the Department of Fish and Wildlife for a Kings River re-forestation project which is under construction on City owned park land adjacent to the Kings River. The project includes the planting of over 250 trees;
- Replacement of all air conditioning units to energy efficient units at the fire department;
- A 26 million dollar upgrade to the Waste Water treatment plant that included energy efficient pumps etc.;
- Construction in progress of an 8 million dollar water tower that will allow us to pump water at night and not during peak hours of the day;
- The City has actively pursued solar power options for the airport, waste water treatment plant, and other government facilities;
- The City of Reedley transit vans are all powered by CNG.


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Introduction

General Methodology

Local Government Operations Protocol

A national standard called the Local Government Operations Protocol (LGO Protocol) has been developed and adopted by the ARB in conjunction with ICLEI, the California Climate Action Registry, and The Climate Registry. This standard provides accounting principles, boundaries, quantification methods, and procedures for reporting greenhouse gas emissions from local government operations. The LGO Protocol forms the basis of ICLEI's Clean Air & Climate Protection Software (CACP 2009), which allows local governments to compile data and perform the emissions calculations using standardized methods.

Greenhouse Gases and Carbon Dioxide Equivalent

In accordance with LGO Protocol recommendations, CACP 2009 calculates and reports all six internationally recognized greenhouse gases regulated under the Kyoto Protocol (Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride). Emissions summaries found throughout this report also use CACP 2009's ability to combine emissions from the various greenhouse gases into carbon dioxide equivalent, CO_2e. Since equal quantities of each greenhouse gas have more or less influence on the greenhouse effect, converting all emissions to a standard metric, CO_2e, allows apples-to-apples comparisons amongst quantities of all six emissions types. Greenhouse gas emissions are reported in this inventory as metric tons of CO_2e ($MTCO_2e$).

Table 2 exhibits the greenhouse gases and their global warming potential (GWP), a measure of the amount of warming a greenhouse gas may cause compared to the amount of warming caused by carbon dioxide.

Table 2: Greenhouse Gases

Gas	Chemical Formula	Activity	Global Warming Potential (CO_2e)
Carbon Dioxide	CO_2	Combustion	1
Methane	CH_4	Combustion, Anaerobic Decomposition of Organic Waste (Landfills, Wastewater), Fuel Handling	21
Nitrous Oxide	N_2O	Combustion, Wastewater Treatment	310
Hydrofluorocarbons	Various	Leaked Refrigerants, Fire Suppressants	12–11,700
Perfluorocarbons	Various	Aluminum Production, Semiconductor Manufacturing, HVAC Equipment Manufacturing	6,500–9,200
Sulfur Hexafluoride	SF_6	Transmission and Distribution of Power	23,900

Calculating Emissions

In general, emissions can be quantified in two ways:

1. Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions from a monitoring system. Emissions measured this way may include those emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility. This method is the most accurate way of inventorying emissions from a given source, but is generally available for only a few sources of emissions.

2. Calculation-based methodologies refer to an estimate of emissions calculated based upon measurable ***activity data*** and ***emission factors***. Table 3 provides examples of common emissions calculations.

Table 3: Basic Emissions Calculations

Activity Data	x	Emissions Factor	=	Emissions
Electricity Consumption (kilowatt hours)		CO_2 emitted/kWh		CO_2 emitted
Natural Gas Consumption (therms)		CO_2 emitted/therm		CO_2 emitted
Gasoline/Diesel Consumption (gallons)		CO_2 emitted /gallon		CO_2 emitted
Waste Generated by Government Operations (tons)		CH_4 emitted/ton of waste		CH_4 emitted

The Scopes Framework

This inventory reports greenhouse gas emissions by sector and additionally by "scope", in line with the LGO Protocol and World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) Greenhouse Gas Emissions Protocol Corporate Standard.

Scope 1: Direct emissions from sources within a local government's operations that it owns and/or controls, with the exception of direct CO_2 emissions from biogenic sources. This includes stationary combustion to produce electricity, steam, heat, and power equipment; mobile combustion of fuels; process emissions from physical or chemical processing; fugitive emissions that result from production, processing, transmission, storage and use of fuels; leaked refrigerants; and other sources.

Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.

Scope 3: All other emissions sources that hold policy relevance to the local government that can be measured and reported. This includes all indirect emissions not covered in Scope 2 that occur as a result of activities within the operations of the local government. Scope 3 emission sources include (but are not limited to) tailpipe emissions from employee commutes, employee business travel, and emissions resulting from the decomposition of government-generated solid waste.

ICLEI and the LGO Protocol provide standard methodologies for calculating emissions from the sources shown in the following table. Other sources of emissions, such as those associated with the production of consumed products do not yet have standard calculation methodologies and are thus excluded from this inventory.

Table 4: Inventoried Emissions Sources by Scope

Scope 1	Scope 2	Scope 3
Fuel consumed at facilities	Purchased electricity consumed by facilities	Solid waste generated by government operations
Fuel consumed by vehicle fleet and mobile equipment	Purchased electricity consumed by electric vehicles	Fuel consumed by vehicles during employee commuting
Fuel consumed to generate electricity	Purchased steam	
Leaked refrigerants from facilities and vehicles	Purchased cooling (chilled water)	
Leaked / deployed fire suppressants		
Solid waste in government landfills		
Wastewater decomposition and treatment at a municipal wastewater treatment plant		

Organizational Boundaries

The organizational boundary for the inventory determines which aspects of operations are included in the emissions inventory, and which are not. Under the LGO Protocol, two control approaches are used for reporting emissions: operational control or financial control. A local government has operational control over an operation if it has full authority to introduce and implement policies that impact the operation. A local government has financial control if the operation is fully consolidated in financial accounts. If a local government has joint control over an operation, the contractual agreement will have to be examined to see who has authority over operating policies and implementation, and thus the responsibility to report emissions under operational control.

LGO Protocol strongly encourages local governments to utilize operational control as the organization boundary for a government operations emissions inventory. Operational control is believed to most accurately represent the emissions sources that local governments can most directly influence, and this boundary is consistent with other environmental and air quality reporting program requirements. For this reason, this inventory was conducted according to the operational control framework.

Types of Emissions

As described in the LGO Protocol, emissions from each of the greenhouse gases can come in a number of forms:

Stationary or mobile combustion: These are emissions resulting from on site combustion of fuels (natural gas, diesel, gasoline, etc.) to generate heat, electricity, or to power vehicles and mobile equipment.

Purchased electricity: These are emissions produced by the generation of power from utilities outside of the jurisdiction.

Fugitive emissions: Emissions that result from the unintentional release of greenhouse gases into the atmosphere (e.g., leaked refrigerants, methane from waste decomposition, etc.).

Process emissions: Emissions from physical or chemical processing of a material (e.g., wastewater treatment).

Significance Thresholds

Within any local government's own operations there will be emission sources that fall within Scope 1 and Scope 2 that are minimal in magnitude and difficult to accurately measure. Within the context of local government operations, emissions from leaked refrigerants and backup generators may be common sources of these types of emissions. For these less significant emissions sources, LGO Protocol specifies that up to 5 percent of total emissions can be reported using methodologies that deviate from the recommended methodologies in LGO Protocol. In the context of registering emissions with an independent registry (such as the California Climate Action Registry), emissions that fall under the significance threshold are called ***de minimis***.

In this report, some emissions were calculated using methods that deviate from the methods recommended in the LGO Protocol. However, the LGO Protocol identifies several alternative methods that still meet emission calculation standards. For the following areas, alternative methods were used to calculate emissions:

- Scope 1 gasoline and diesel consumption
- Scope 1 fugitive emissions from the leakage of refrigerants from vehicles
- Scope 2 CO_2 emissions from purchased electricity used to power facilities

In addition, emissions data from the following sources could not be obtained for this report and therefore emissions from these sources are not included in this inventory:

- Scope 1 fugitive emissions from the leakage of fire suppressants from stationary and mobile units
- Scope 3 CH_4 waste-related emissions from the decomposition of organic solid waste from government-generated solid waste
- Scope 1 Back-up generators emissions
- Scope 1 Stationary Methane Emissions from Incomplete Combustion of Digester Gas
- Scope 1 Process Methane Emissions from Lagoons
- Scope 1 Fugitive Methane Emissions from Septic Systems from the Airport
- Scope 1Process N_2O Emissions from Centralized Wastewater Treatment and Effluent Discharge to Aquatic Environments
- Scope 1 CO_2 Emissions from biogas combustion (biogenic)

- Scope 1 Propane use at the Airport
- Scope 1 Mobile Source of Fleet and Transit Incomplete Combustion based on Vehicle Miles Traveled
- Scope 1 Transit Vehicles Fugitive Emissions-Leaked Refrigerants, funded by the County of Fresno
- Scope 1 Mobile Fuel Combustion (consumption), grounds keeping equipment, etc.
- Scope 3 Contracted Services Various Facilities or Mobile Sources (e.g., trash collection, snow removal, mowing/landscaping services) Fuel Consumption

Understanding Totals

It is important to realize that the totals and sub-totals listed in the tables and discussed in this report are intended to represent all-inclusive, complete totals for the City of Reedley's operations. However, these totals are only a summation of inventoried emissions using available estimation methods. Each inventoried sector may have additional emissions sources associated with them that were unaccounted for, such as Scope 3 sources that could not be estimated.

Also, local governments provide different services to their citizens, and the scale of the services (and thus the emissions) is highly dependent upon the size and purview of the local government. For these reasons, comparisons between local government totals should not be made without keen analysis of the basis for figures and the services provided.

It is important to understand that in the case where a local government operates a municipal utility that generates electricity for government facilities, the associated emissions should be considered Scope 1 emissions within the Power Generation Facilities sector, and not Scope 2 emissions within each of the other facilities sectors, when calculating a total. This is advised by the LGO Protocol and done to avoid reporting the same emissions twice, also known as double counting.

Inventory Results

Emissions Total

In 2005, the City of Reedley's greenhouse gas emissions from government operations totaled 2,205.38 metric tons of CO_2e. This number represents a roll-up of emissions. While the roll-up is a valuable figure, information on the breakdown of emissions from local government operations by scopes, sources, and sectors allows the comparative analysis and insight needed for effective decision-making on target setting, developing GHG reduction measures, or monitoring. The LGO Protocol and ICLEI identify reporting by scopes, sources, and sectors as the strongly preferred form of reporting a greenhouse gas inventory. For more details on the breakdown of Reedley's emissions by scopes, sources, and sectors, refer to subsequent sections within Inventory Results in this report.

Buildings and Other Facilities

Facility operations contribute to greenhouse gas emissions in two major ways. First, facilities consume electricity and fuels such as natural gas. This consumption is associated with the majority of greenhouse gas emissions from facilities. In addition, fire suppression, air conditioning, and refrigeration equipment in buildings can emit hydrofluorocarbons (HFCs) and other greenhouse gases when these systems leak refrigerants or fire suppressants. Refrigerants and fire suppressants are very potent greenhouse gases and have Global Warming Potential (GWP) of up to many thousand times that of CO_2. For example, HFC-134a, a very common refrigerant, has a GWP of 1300, or 1300 times that of CO_2. Therefore, even small amounts of leaked refrigerants can have a significant effect on greenhouse gas emissions.

The City of Reedley operates 16 facilities, ranging from general City Hall offices to the Opera House and Parks. For the purpose of reporting emissions, these facilities were grouped by department when possible. Facilities that were unknown or previously uncategorized were included in this section of the inventory and were assigned to a category called "Unknown." Data relating to natural gas consumption were obtained from The Gas Company. Data relating to electricity consumption were obtained from PG&E. Data relating to fuel consumption were obtained from the City of Reedley's Financial Department.

The Buildings and Facilities sector produced the fifth-largest amount of emissions by sector. Overall, these facilities produced 243.11 metric tons of CO_2e (11% of total emissions). As illustrated in Figure 3, the facility group producing the most greenhouse gas emissions in the City of Reedley is the Parks and Recreation facility at 45%. The second largest contributor is the Administration facility at 31%.

As illustrated in Figure 4, the source producing the most greenhouse gas emissions in the Buildings and Facilities sector is purchased electricity at 76.7%, followed by natural gas at 22.7%. Diesel, used to power backup generators across the City was not accounted for due to lack of available data.

Figure 3: Buildings and Other Facilities Emissions by Department

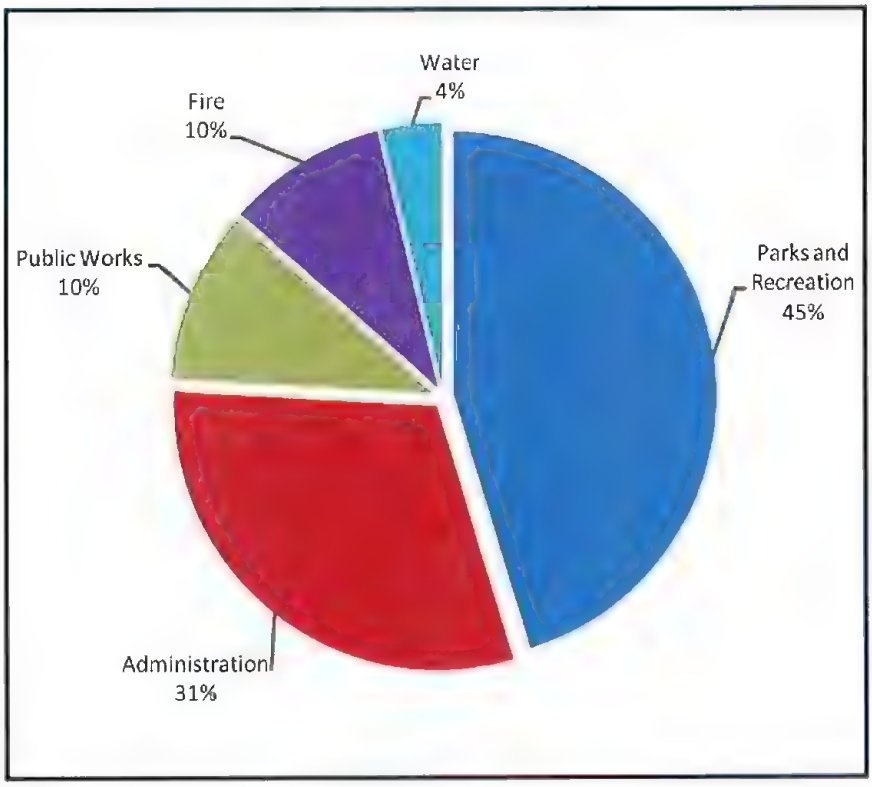

Table 5: Buildings and Other Facilities Emissions by Department

Department	metric tons CO_2e
Parks and Recreation	110.20
Administration	74.38
Public Works	25.69
Fire	23.87
Water	8.96
Totals	**243.11**

Figure 4: Buildings and Other Facilities Emissions by Source

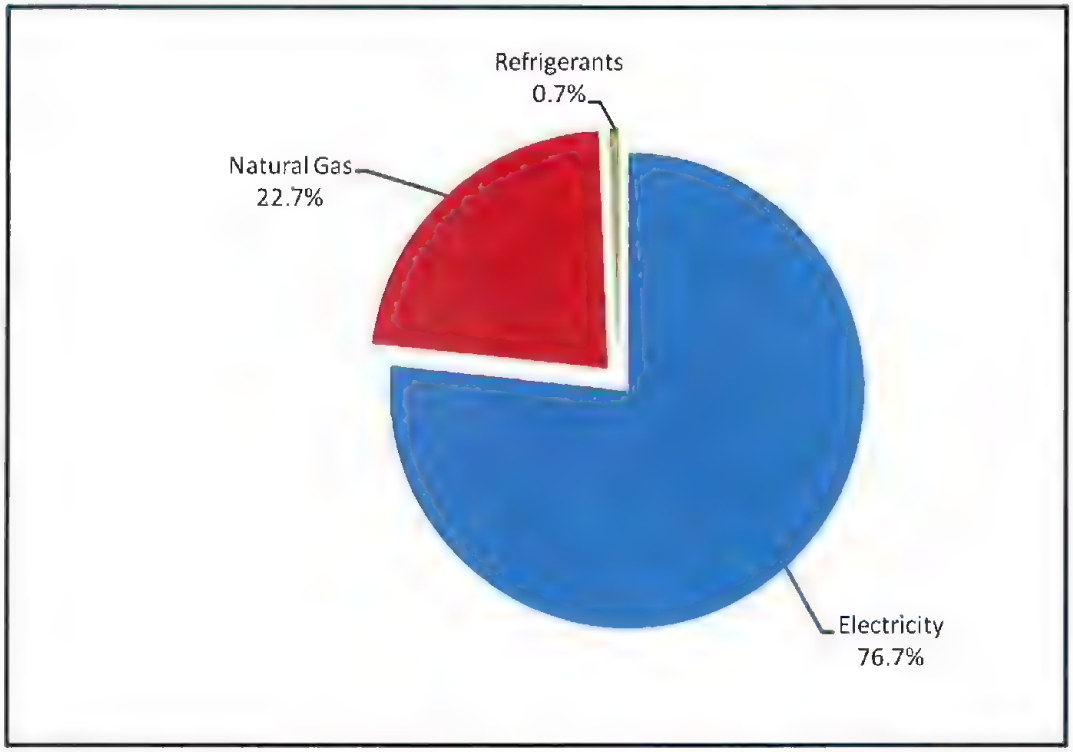

Table 6: Buildings and Other Facilities Emissions by Source

Source	metric tons CO_2e
Electricity	186.42
Natural Gas	55.10
Refrigerants	1.60
Totals	**243.11**

Table 7: Buildings Sector Emissions by Scope and Emission Type

Scope / Emission Type	Greenhouse Gas Emissions (metric tons)				
SCOPE 1	CO_2e	CO_2	CH_4	N_2O	R-410A Blend
Stationary Combustion	55.10	54.96	0.01	0.00	0.0000
Fugitive Emissions	1.60	0.00	0.00	0.00	0.0009
Total Direct Emissions	**56.69**	**54.96**	**0.01**	**0.00**	**0.0009**
SCOPE 2	CO_2e	CO_2	CH_4	N_2O	
Purchased Electricity	186.42	184.89	0.01	0.00	
Total Indirect Emissions	**186.42**	**184.89**	**0.01**	**0.00**	
INDICATORS					
Number of Employees	110				

Streetlights, Traffic Signals, and Other Public Lighting

Like most local governments, the City of Reedley operates a range of public lighting including traffic signals, traffic control lighting, holiday lighting, park lights, and parking lot lighting. The majority of emissions associated with the operation of this infrastructure are due to electricity consumption. Data relating to electricity consumption for public lighting was obtained from PG&E.

The Public Lighting sector produced the sixth-largest amount of emissions of all sectors overall. Overall, these facilities produced 150.89 metric tons of CO_2e (7% of total emissions). As illustrated in Figure 5 and Table 8, the subsector producing the most greenhouse gas emissions in the Public Lighting sector is Street Lights at 71%, followed by Other Outdoor Lighting at 16%.

Figure 5: Public Lighting Emissions by Subsector

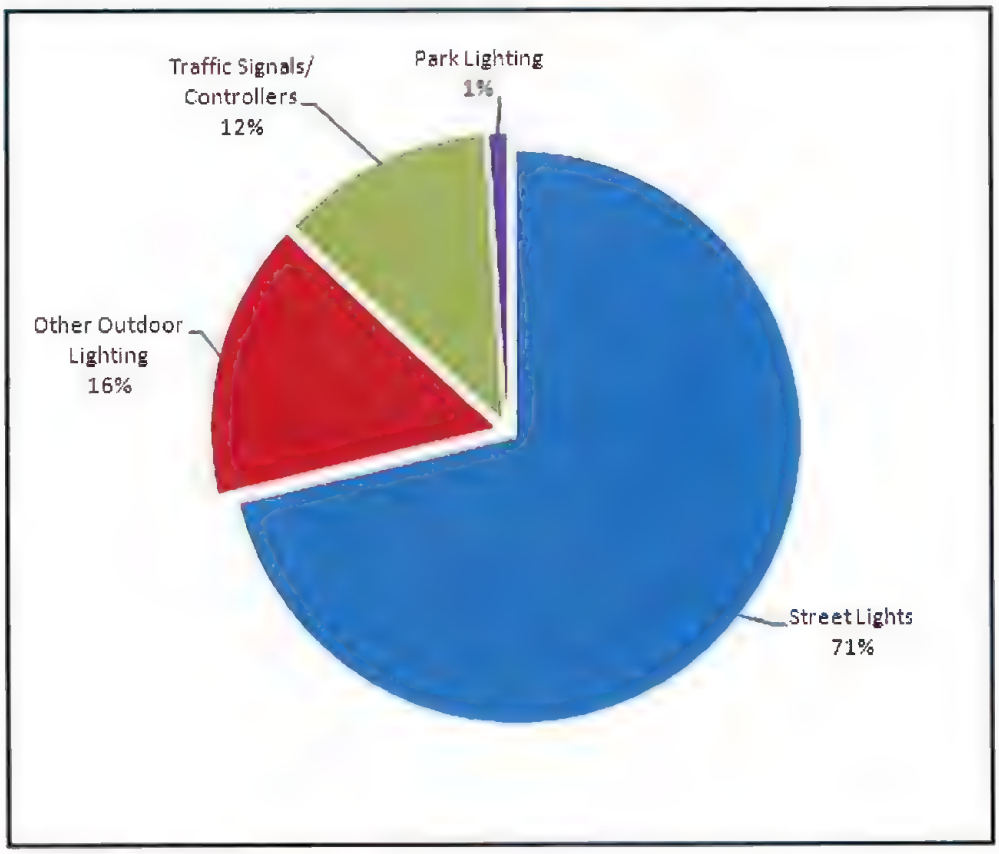

Table 8: Public Lighting Emissions by Subsector

Subsector (Light Type)	metric tons CO_2e	% of Sector Emissions	Electricity Use (kWh)	Cost ($)
Street Lights	107.60	71%	480,954	$143,106
Other Outdoor Lighting	23.52	16%	105,145	$15,761
Traffic Signals/Controllers	18.29	12%	81,776	$12,582
Park Lighting	1.47	1%	6,593	$1,047
Totals	**150.89**	**100%**	**674,468**	**$172,496**

Table 9: Public Lighting Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
SCOPE 2		CO_2e	CO_2	CH_4	N_2O
	Purchased Electricity	150.89	149.65	0.01	0.00
	Total Indirect Emissions	150.89	149.65	0.01	0.00

Water Delivery Facilities

This sector includes emissions from equipment used for the distribution or transport of water, including drinking water, sprinkler systems and irrigation. The City of Reedley operates a range of water transport equipment, including seven active water wells, which pump approximately 1.4 billion gallons of water per year. The system has approximately 436,475 linear feet of water main line in a various sizes. Electricity consumption and the on-site combustion of fuels such as natural gas and diesel are significant sources of greenhouse gas emissions from the operation of the City of Reedley's water transport equipment. Data relating to electricity consumption was obtained from PG&E. Data relating to backup generators and fuel consumption could not be obtained from the City's Public Works Department for the baseline year of 2005.

Note: this sector of the inventory does not include those park sprinkler controls, which could not be disaggregated from multipurpose park light and sprinkler control records.

The Water Transport sector produced the second-largest amount of emissions overall, with 483.93 metric tons of CO_2e (22% of total emissions). As illustrated in Figure 6 and Table 10, the subsector producing the most greenhouse gas emissions in the Water Transport sector is Water Delivery Pumps (kWh) at 99.6%, followed by Water Delivery Pumps (therms) at 0.3%.

Figure 6: Water Delivery Facilities Emissions by Subsector

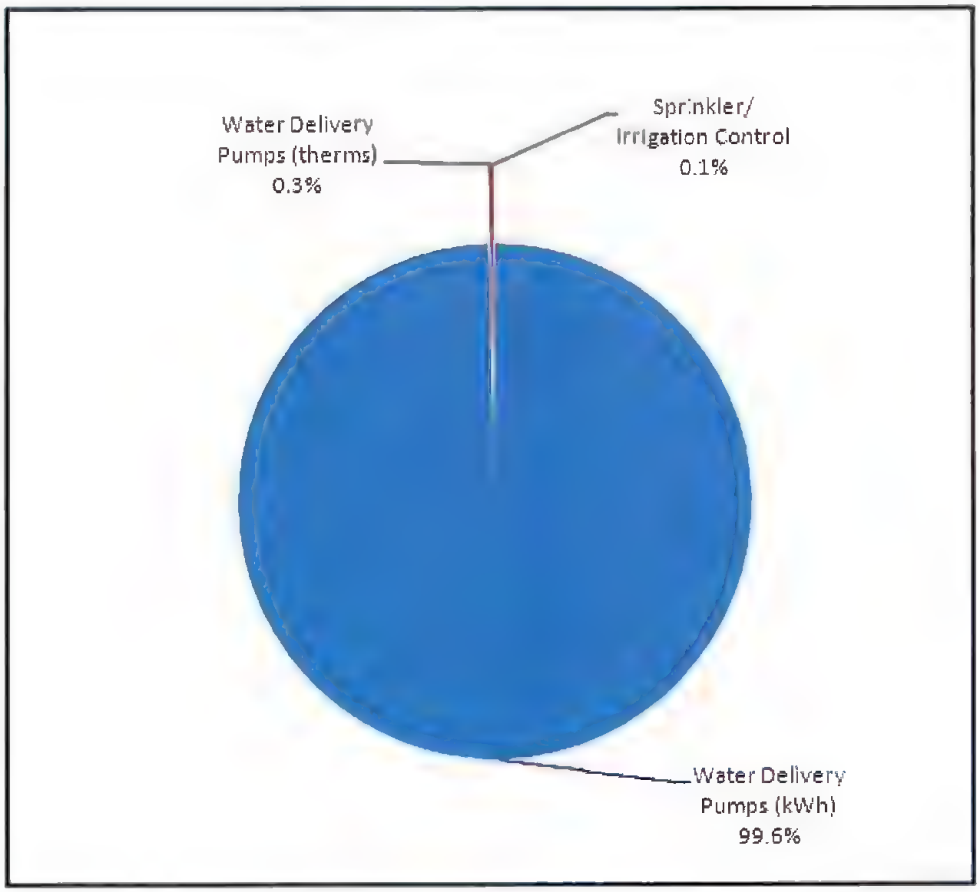

Table 10: Water Delivery Facilities Emissions by Subsector

Subsector (Equipment Type)	metric tons CO_2e	% of Sector Emissions	Electricity Use (kWh)	Electricity Cost ($)	Natural Gas Use (Therms)	Natural Gas Cost ($)
Water Delivery Pumps (kWh)	481.94	99.6%	2,154,293	$ 259,208	0	$ 0
Water Delivery Pumps (therms)	1.50	0.3%	0	$ 0	282	$ 626
Storm Water Management	0.19	0.0%	840	$ 231	0	$ 0
Sprinkler/Irrigation Control	0.30	0.1%	1,346	$ 966	0	$ 0
Totals	**483.93**	**100%**	**2,156,479**	**$ 260,405**	**282**	**$ 626**

Table 11: Water Delivery Facilities Emissions by Scope and Emission Type

Scope / Emission Type	Greenhouse Gas Emissions (metric tons)			
SCOPE 1	CO_2e	CO_2	CH_4	N_2O
Stationary Combustion	1.50	1.50	0.00	0.00
Fugitive Emissions	0.00	0.00	0.00	0.00
Total Direct Emissions	**1.50**	**1.50**	**0.00**	**0.00**
SCOPE 2	CO_2e	CO_2	CH_4	N_2O
Purchased Electricity	482.43	478.48	0.03	0.01
Total Indirect Emissions	**482.43**	**478.48**	**0.03**	**0.01**

Wastewater Treatment Facilities

Wastewater coming from homes and businesses is rich in organic matter and has a high concentration of carbon and nitrogen (along with other organic elements). As wastewater is collected, treated, and discharged, chemical processes in aerobic and anaerobic conditions lead to the creation and emission of two greenhouse gases: methane and nitrous oxide. Local governments that operate wastewater treatment facilities, including treatment plants, septic systems, collection lagoons, and other facilities, must therefore account for the emission of these gases.

Electricity consumption and the on-site combustion of fuels such as natural gas and diesel are also significant sources of greenhouse gas emissions from the operation of wastewater treatment facilities. Data relating to electricity consumption was obtained from PG&E. Data relating to backup generators and fuel consumption could not be obtained from the City's Public Works Department for the baseline year 2005.

The City of Reedley has operated the Reedley Waste Water Treatment Plant in its current condition since 2009. In 1982 and 1998 the Plant received major expansions to accommodate the growing population. The treatment plant covers approximately 60 acres and has a design capacity of 5 million gallons per day. The City of Reedley currently has seven active water wells, which supply approximately 1.4 billion gallons water per year. To transport this water, the City has approximately 436,475 linear feet of water main line in various sizes. In 2005, these facilities were not in their current state of operation. Prior to the expansion in 2009 to the facilities that currently exist, the Plant served approximately 23,341 people, including the residents and businesses located in only the City of Reedley.

The Wastewater Treatment sector produced the third-largest amount of emissions in this inventory. Overall, these facilities produced 434.91 metric tons of CO_2e (20% of total emissions). As illustrated in Figure 7 and Table 12, the subsector producing the most greenhouse gas emissions in the Wastewater Treatment sector is Facility Energy Use at 98%, followed by Lift Pump and Sewer Lift Station at 1%.

Figure 7: Wastewater Treatment Facilities Emissions by Subsector

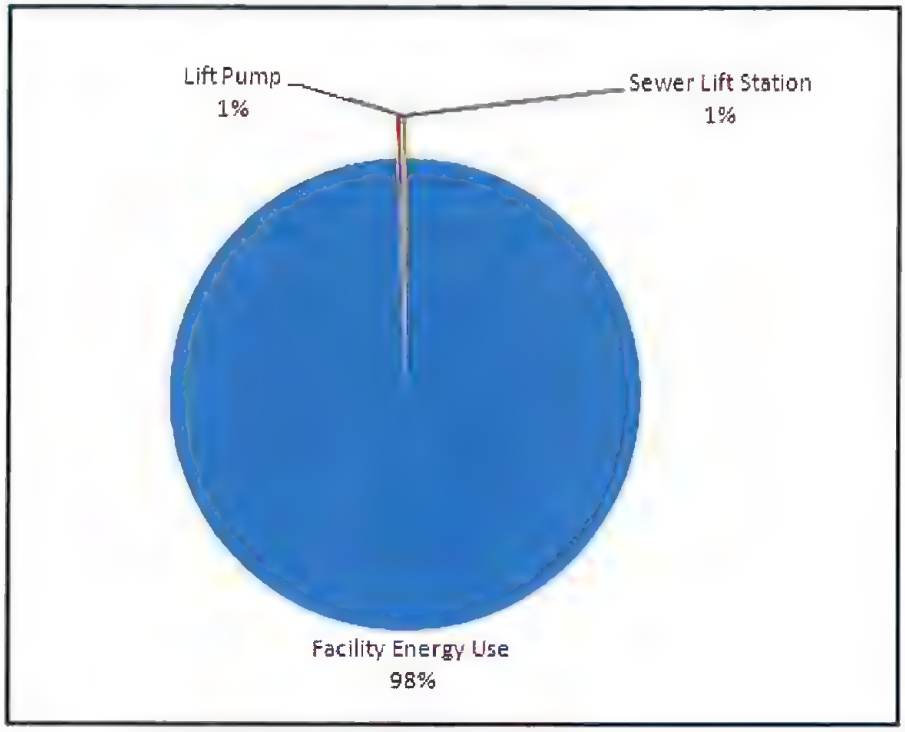

Table 12: Wastewater Treatment Facilities Emissions by Subsector

Subsector	metric tons CO_2e
Wastewater Treatment Facility	432.11
Sewer Lift Station	1.41
Lift Pump	1.39
Totals	**434.91**

Table 13: Wastewater Treatment Facilities Emissions by Scope and Emission Type

Scope / Emission Type	Greenhouse Gas Emissions (metric tons)						
SCOPE 1	CO_2e	CO_2	CH_4	N_2O	HFC 134a	R-401A Blend	R-410A Blend
Stationary Combustion	0.00	0.00	0.00	0.00	0.000	0.00	0.00
Fugitive Emissions	109.90	0.00	0.00	0.00	0.001	0.02	0.06
Total Direct Emissions	**109.90**	**0.00**	**0.00**	**0.00**	**0.001**	**0.02**	**0.06**
SCOPE 2	CO_2e	CO_2	CH_4	N_2O			
Purchased Electricity	325.02	322.35	0.02	0.01			
Total Indirect Emissions	**325.02**	**322.35**	**0.02**	**0.01**			

Airport Facilities

Electricity consumption is the only significant sources of greenhouse gas emissions from the operation of the City of Reedley's Airport Facilities. Data relating to electricity consumption was obtained from PG&E. The Airport Facilities use propane as a heating source but no data was discovered for baseline year 2005.

The Airport Facilities sector produced the one of the least amount of emissions in this inventory. Overall, these facilities produced 11.34 metric tons of CO_2e.

Table 14: Airport Facilities Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)	
Scope 2		CO_2e	CO_2
	Purchased Electricity	11.34	11.25
	Total Indirect Emissions	**11.34**	**11.25**

Vehicle Fleet and Mobile Equipment

The vehicles and mobile equipment used in the City of Reedley's daily operations include: heavy duty trucks responding to emergency fire calls; heavy and light trucks used for landscape and maintenance tasks; passenger cars, light trucks, and sport utility vehicles (SUVs) driven on a variety of site visits, including building inspections; among others. Most vehicles consume gasoline, some consume diesel, and each results in greenhouse gas emissions. Gasoline and diesel-powered maintenance equipment contributes to greenhouse gas emissions as well; however, exact figures for on and off-road fuel consumption could not be acquired for individual equipment, so aggregate fuel data was used. In addition, vehicles with air conditioning or refrigeration equipment use refrigerants that can leak from the vehicle.

In 2005, the City of Reedley operated a vehicle fleet. The number of vehicles and the number of pieces of equipment are not known. As a result of the lack of specific data, the Alternative Method was used, which relies on aggregated amount of fuels used.

While refrigerants are estimated to have contributed 42.90 metric tons of CO_2e (7% of total emissions), it should be noted that the default emission rates method was used to estimate emissions from leaked refrigerants. While this method can significantly overestimate the actual amount of leaked refrigerant, this method is in line with LGO Protocol methods. The figure generated here is a conservative amount in lieu of exact amounts, which were not available. Once again, the default method and other methods will be discussed in greater detail in the "Inventory Methodologies" section. Emissions from ozone depleting chemicals used as refrigerants in vehicles produced before 1995 (e.g. R-12) were included as an information item in this inventory since these chemicals are regulated by the Montreal Protocol and are currently being phased out of use.

The Vehicle Fleet sector produced the largest amount of emissions in this inventory. Overall, this sector produced 618.90 metric tons of CO_2e (28% of total emissions). As illustrated in Figure 8 and Table 15, the source producing the most greenhouse gas emissions in the Vehicle Fleet sector was Gasoline at 56%, followed by Diesel at 37%.

Figure 8: Vehicle Fleet Emissions by Source

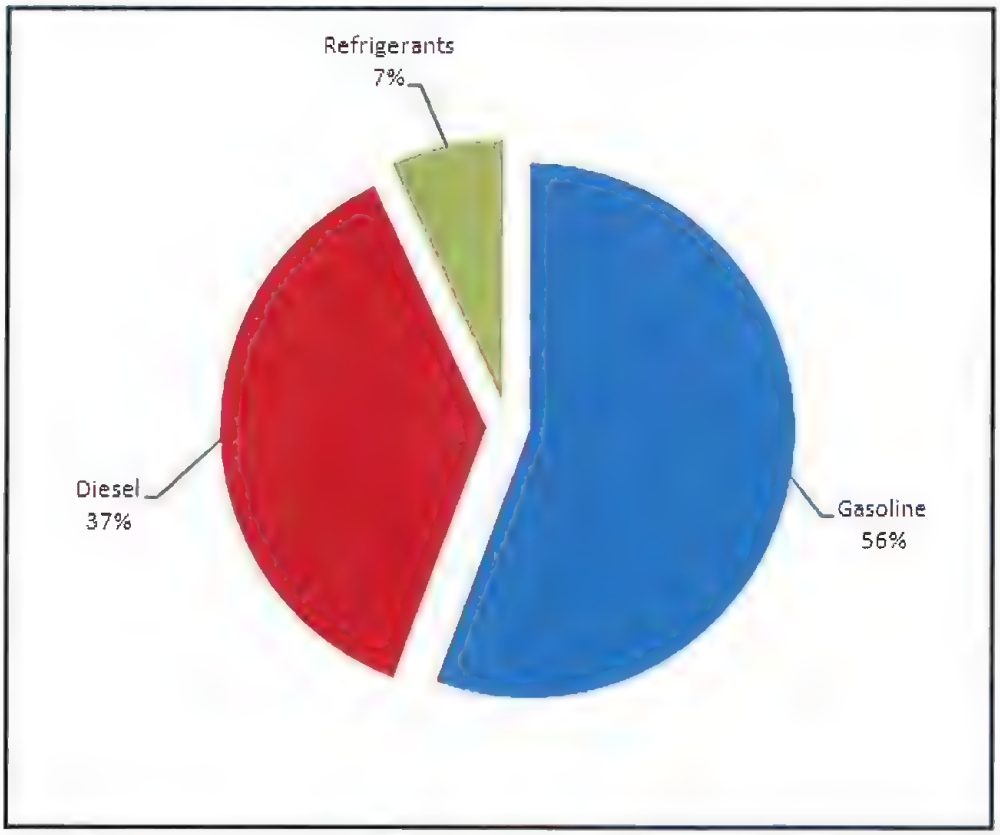

Table 15: Vehicle Fleet Emissions by Source

Source	metric tons CO_2e	Consumption Quantity	Consumption Units	Cost ($)
Gasoline	344.26	39,210	Gallons	$93,976
Diesel	231.74	22,697	Gallons	$54,432
Refrigerants	42.90	0	Tonnes	$0
Totals	**618.90**	**61,907**		**148,408**

Table 16: Vehicle Fleet Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)				
SCOPE 1		CO_2e	CO_2	CH_4	N_2O	HFC 134a
	Mobile Combustion	576.00	576.00	0.00	0.00	0.00
	Fugitive Emissions	42.90	0.00	0.00	0.00	0.03
	Total Direct Emissions	**618.90**	**576.00**	**0.00**	**0.00**	**0.03**

Employee Commute

Emissions in the Employee Commute sector are due to combustion of fuels in vehicles used by government employees for commuting to work at the City of Reedley. Results from a survey designed by ICLEI and administered by the City of Reedley are shown below. Current full-time City staff members were surveyed and 98 responses were collected, resulting in a sample of approximately 89% of employees at 2012 staff levels. The survey was used to collect the data needed to calculate emissions and also capture other information that will help the City of Reedley set effective policy addressing this sector.

The Employee Commute sector produced the fourth-largest amount of emissions in this inventory. Overall, this sector produced 262.30 metric tons of CO_2e (12% of total emissions). As illustrated in Figure 9 and Table 17, the vehicle class producing the most greenhouse gas emissions in the sector is the Light Truck/SUV/Pickup/Van category at 59%, followed by Passenger Car at 38%. Nearly all vehicles are fueled by gasoline, with only a few using diesel.

Tables 19 through 24 present summary information from preference-based questions included in the survey. This information is intended to inform the City of Reedley about potential transportation options to increase convenience and productivity while reducing the City's impact on the environment.

Figure 9: Employee Commute Emissions by Vehicle Class

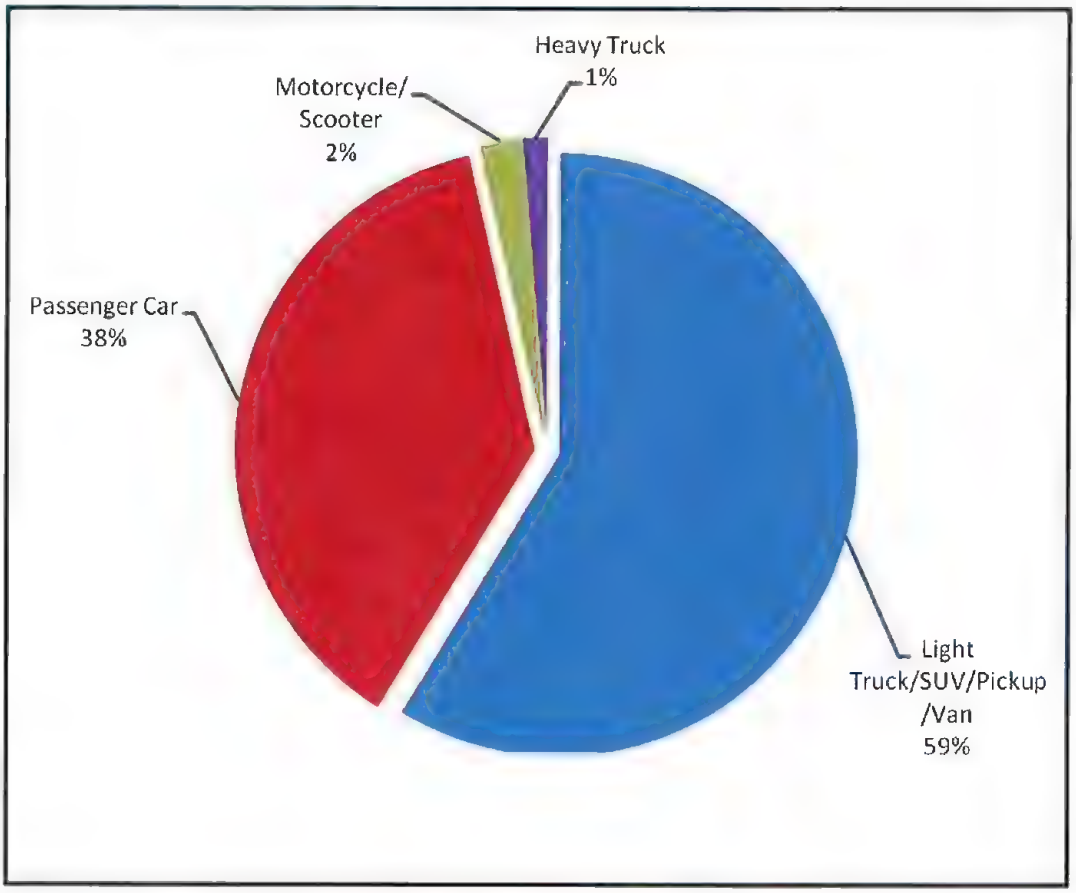

Table 17: Employee Commute Emissions by Vehicle Class

Vehicle Class	metric tons CO_2e
Light Truck/SUV/Pickup/Van	153.98
Passenger Car	98.89
Motorcycle/Scooter	5.88
Heavy Truck	3.54
Totals	**262.30**

Table 18: Employee Commute Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)
SCOPE 3		CO_2e
	Mobile Combustion	262.30
INDICATORS		
	Vehicle miles traveled	564,133
	Number of vehicles	98

Table 19: Employee Commute - Reasons for Not Carpooling Data

Reason	Percentage
Other people do not match my schedule or route	60%
Difficult to find others to carpool/vanpool	24 %
Work late or irregular hours	32%
May not be able to get home quickly in an emergency	28%
Like the privacy when I'm in my own car	26%
Dislike being dependent on others	36%
Need my car on the job	15%
Need to make stops on the way to work or home	38%
Makes my trip too long	3%
I don't know enough about carpooling or vanpooling	0%
Never considered carpooling or vanpooling	7%
Other	9%

Table 20: Employee Commute - Reasons for Not Taking Transit

Reason	Percentage
Transit service doesn't match my route or schedule	53%
It costs too much	6%
It takes too long	26%
It is not safe or easy to walk to work from the transit stop	2%
Not enough parking at the transit stop from which I'd depart	1%
It is too far to walk to work from the transit stop	7%
I work late or irregular hours	27%
May not be able to get home quickly during an emergency	30%
Like the privacy when I'm in my own car	23%
Need my car on the job	13%
Need to make stops on the way to work or home	33%
I don't know enough about taking transit	3%
Never considered using public transit	11%
Other	13%

Table 21: Employee Commute - Reasons for Not Walking/Biking

Reason	Percentage
I live too far away	57%
There isn't a safe or easy route for walking or biking	20%
Weather	35%
No place at work to store bikes safely	8 %
It's not easy to look good and feel comfortable for work after walking or biking	15%
Workplace does not have adequate facilities for showering/changing	16%
May not be able to get home quickly in an emergency	26%
Need to make stops on the way to work or home	23%
Never considered walking or biking to work	9%
I don't know enough about walking or biking to work	0%
Other	13 %

Table 22: Employee Commute - Travel Mode Data

Mode	Percentage
Drive Alone	92%
Carpooling/Vanpooling	4%
Public Transportation	0%
Bicycling	1%
Walking	1%
Telecommute/Other	0%
Split Modes	0%

Table 23: Employee Commute - Miles from Work Data

Miles	Percentage
0-5	40%
6-10	16%
11-15	16%
15-20	6%
21-25	4%
26-30	9%
31-35	4%
36-40	3%
41 45	0%
46 50	1%
51 75	1%
76-100	0%
Over 100	0%

Table 24: Employee Commute - Time to Work Data

Time (Minutes)	Percentage
Less than 5	24%
6 to 15	33%
16 to 25	19%
26 to 35	10%
36 to 45	9%
Over 45	4%


REEDLEY

Next Steps

ICLEI's Five Milestone Process

While the City of Reedley has already begun to reduce greenhouse gas emissions through its actions, this inventory represents the first step in a systematic approach to reducing the City of Reedley's emissions. This system, developed by ICLEI, is called the Five Milestones for Climate Mitigation. This Five Milestone process involves the following steps:

Milestone One: Conduct a baseline emissions inventory and forecast

Milestone Two: Adopt an emissions reduction target for the forecast year

Milestone Three: Develop a local climate action plan

Milestone Four: Implement the climate action plan

Milestone Five: Monitor progress and report results

Figure 10: ICLEI's Five Milestones for Climate Mitigation

ICLEI staff are available to local governments who are members and should be contacted to discuss the full range of resources available at each stage of the Milestone process. The following sections provide a glimpse at next steps and help capture the lessons learned in conducting this inventory.

Setting Emissions Reduction Targets

This inventory provides an emissions baseline that can be used to inform Milestone Two of ICLEI's Five-Milestone process—setting emissions reduction targets for Reedley's municipal operations. The greenhouse gas emissions reduction target is a goal to reduce emissions to a certain percentage below base year levels by a chosen planning horizon year. An example target might be a 30 percent reduction in emissions below 2005 levels by 2020. A target provides an objective toward which to strive and against which to measure progress. It allows a local government to quantify its commitment to fighting global warming—demonstrating that the jurisdiction is serious about its commitment and systematic in its approach.

In selecting a target, it is important to strike a balance between scientific necessity, ambition, and what is realistically achievable. The City of Reedley should give itself enough time to implement chosen emissions reduction measures—noting that the farther out the target year is, the more the City of Reedley should pledge to reduce. ICLEI recommends that regardless of the chosen long term emissions reduction target (e.g., 15-year, 40-year), the City of Reedley should establish linear interim targets for every two- to three-year period. Near-term targets facilitate additional support and accountability, and linear goals help to ensure continued momentum around local climate protection efforts. To monitor the effectiveness of its programs, the City of Reedley should plan to re-inventory its emissions on a regular basis; many jurisdictions are electing to perform annual inventories. ICLEI recommends conducting an emissions inventory every three to five years.

The Long-Term Goal

ICLEI recommends that near-term climate work should be guided by the long-term goal of reducing its emissions by 80 percent to 95 percent below the 2005 baseline level by the year 2050. By referencing a long-term goal that is in accordance with current scientific understanding, the City of Reedley can demonstrate that it intends to do its part towards addressing greenhouse gas emissions from its internal operations.

It is important to keep in mind that it will be next to impossible for local governments to reduce emissions by 80 to 95 percent without the assistance of state and federal policy changes that create new incentives and new sources of funding for emissions reduction projects and programs. However, in the next 15 years, there is much that local governments can do to reduce emissions independently. It is also important that the City of Reedley works to reduce its emissions sooner, rather than later: the sooner a stable level of greenhouse gases in the atmosphere is achieved, the less likely it is that some of the most dire climate change scenarios will be realized. Additionally, if cost saving projects can be undertaken now – why wait to increase the quality of local government service and operations, while reducing taxpayer costs?

State of California Targets and Guidance

An integral component of the State of California's climate protection approach has been the creation of three core emissions reduction targets at the community level. While these targets are specific to the community scale, they can be used to inform emissions targets for government operations as well. On June 1, 2005, California Governor Schwarzenegger signed Executive Order S-3-05 establishing climate change emission reductions targets for the State of California. The California targets are an example of near-, mid- and long-term targets:

- Reduce emissions to 2000 levels by 2010
- Reduce emissions to 1990 levels by 2020
- Reduce emissions to 80 percent below 1990 levels by 2050

The AB 32 Scoping Plan also provides further guidance on establishing targets for local governments; specifically the Plan suggests creating an emissions reduction goal of 15 percent below "current" levels by 2020. This target has informed many local government's emission reduction targets for municipal operations—most local governments in California with adopted targets have targets of 15 to 25 percent reductions under 2005 levels by 2020.

Departmental Targets

If possible, ICLEI recommends that the City of Reedley consider department-specific targets for each of the departments that generate emissions within its operations. This allows the City of Reedley staff to do a more in depth analysis of what is achievable in each sector in the near, mid and long-term, and also encourages department leaders to consider their department's impact on the climate and institute a climate conscious culture within their operations.

Creating an Emissions Reduction Strategy

This inventory identifies the major sources of emissions from the City of Reedley's operations and, therefore, where policymakers will need to target emissions reductions activities if they are to make significant progress toward adopted targets. For example, since Vehicle Fleet was a major source of emissions from the City of Reedley's operations, it is possible that the City of Reedley could meet near-term targets by implementing a few major actions within the Vehicle Fleet. Medium-term targets could be met by focusing emissions reduction actions on the Water Transport, Water Treatment Facilities and Employee Commute, and the long term (2050) target will not be achievable without major reductions in all of these sectors.

Please note that, whenever possible, reduction strategies should include cost-saving projects that both reduce costs (such as energy bills) while reducing greenhouse gas emissions. These "low hanging fruit" are important because they frequently represent win-win situations in which there is no downside to implementation. Selecting these projects in the

order of largest to smallest benefit ensures that solid, predictable returns can be realized locally. These projects lower recurring expenditures, save taxpayer dollars, create local jobs, and benefit the community environmentally.

Given the results of the inventory, ICLEI recommends that the City of Reedley focus on the following tasks in order to significantly reduce emissions from its government operations:

General:

- Participate in Phase II of Green Communities: Community-Wide Inventories, in order to gather necessary data to develop effective policies which result in extensive reductions through implementation of a Climate Action Plan for the larger community;
- Promote training, education, rewards, incentives, encouragement and support for emissions reductions across the board;

Buildings and Facilities:

- Change procurement policy to specify energy star compliant HVAC systems and refrigerators;
- Comprehensive municipal retrofit of existing buildings including lighting, insulation, windows and HVAC systems for improved energy efficiency, cost savings, and building performance;
- Develop an equipment database to help with the reuse of old furniture and fixtures;
- Install smart lighting fixtures with occupancy sensors;
- Perform a comprehensive energy retrofit of existing buildings, especially the older buildings;
- Procure solar or other low-carbon based electricity;
- Review feasibility of alternative energy production at City facilities;
- Switch to refrigerants that have a lower GWP (global warming potential);

Public Lighting:

- Analyze reduction potential for streetlights and other public lighting;
- Analyze reduction potential for the LS 1 designated streetlights;
- Switch traffic signals and public lighting from incandescent bulbs to Light Emitting Diodes (LEDs);

Wastewater Sector:

- Additional treatment to effluent water to reduce process methane emissions;

Government Generated Waste:

- Change procurement policy to recommend recycled, reusable and recyclable materials, including office supplies (e.g. paper, cardboard, cans, toner cartridges);

- Comprehensive analysis of waste stream;
- Implement paper and toner reduction strategies to reduce excess paper and toner usage, e.g. double-sided printing and fonts that use less ink (i.e., Century Gothic, Times New Roman and Calibri);
- Increase office reuse and recycling (e.g. paper, cardboard, cans, toner cartridges);

Vehicle Fleet:

- Exploration of biofuels to replace vehicle fleet fuel usage;
- Explore implementing a no idling policy for fleet vehicles;
- Reduce usage of city-owned vehicles, replace those which are not fuel efficient, and change procurement policy to specify high fuel efficiency for each vehicle class;
- Promote procurement of plug-in hybrids where practical, which can reduce vehicle emissions by up to 50% in PG&E territory;
- Specify high fuel efficiency during procurement for new vehicles of all classes;

Employee Commute:

- Encourage and incentivize telecommuting to reduce emissions from employee commute;
- Encourage employees to use alternative modes of transportation by offering enhanced commuter benefits;
- Explore various policies to encourage walking and biking in good weather by employees that live within 5 miles, and to encourage carpooling by all employees;
    - Give incentives for employees to use the transit system or carpool;
    - Implement a Commute Trip Reduction (CTR) program (e.g. carpooling and biking incentives) (http://www.vtpi.org/tdm/tdm9.htm);
- Implement employee commute programs aimed at reducing greenhouse gas emissions;
- Recommend and incentivize carpooling to reduce emissions from employee commute.

Using these strategies as a basis for a more detailed overall emissions reductions strategy, or climate action plan, the City of Reedley should be able to reduce its impact on global warming. In the process, it may also be able to improve the quality of its services, reduce costs, stimulate local economic development, and inspire local residents and businesses to redouble their own efforts to combat climate change.


Welcome
to
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Appendix A: Inventory Methodologies

ICLEI's Clean Air & Climate Protection Software (CACP 2009) software made it possible to calculate greenhouse gas emissions for the following greenhouse gases: Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride. Activity data was collected for a number of operations through a number of methods. Activity data was stored in Master Data Workbook (MDWB), which serves as a tool for organizing and conditioning data, and, in some cases, calculating emissions. Data collection methods range from LGO Protocol-recommended, to LGO Protocol alternative and non LGO Protocol (but ICLEI-approved) alternatives. The methods used depend on the availability and format of data. Inputting activity data into CACP 2009, along with the correct emission factor, resulted in the calculation of greenhouse gas emissions for the City of Reedley's 2005 government operations.

Activity Data

All of the utility-derived electrical information was provided by Pacific Gas & Electric. The point of contact was John Joseph, Rate Data Analysis. The data he provided was for the base line year 2005 in a Microsoft Excel Spreadsheet. He provided information for the 16 City facilities: the Opera House, the Art Gallery, the Community Center, Beach Park, the City Equipment Repair Shop, Pioneer Park Stage, the Packing House, the Water Department building, City Hall, Fire Station, a park, Camacho Park, Public Bathroom #1, Public Restrooms # 2, an unknown facility (was destroyed some years back), and the swimming pool.

The data provided by PG&E was in a raw format, so the data had to be conditioned to allow it to be usable for the GHG Inventory. The conditioning process consisted of locating the baseline year data in the "Data" tab of the provided Excel file. A new tab was created within the same file named "2005". The copied data was pasted to the new tab. That same data was then copied and pasted in the MDW's "FA-Utility Raw Data" tab to be conditioned. The data was categorized by color; yellow represents streetlights, blue the water transport system; and white the facilities and buildings. The data was then copied by color type and pasted in the appropriate data associated with the data type raw data tab.

Southern California Gas Company provided the natural gas information, which was obtained through the City Accounting Department Records. Lori Oken, Finance Director, provided access to the City's Financial Records. Each

monthly record was digitally copied to a PDF file. The PDFs were then conditioned by creating a spreadsheet Excel file. The monthly statements were combined to create a summation of the individual accounts. The information was copied and pasted into the "FA-Other Fuel Raw Data" tab in the Master Data Workbook. The individual account's data for each specific facility was copied and pasted into the specific tab associated with each facility. In addition to the natural gas data being acquired from the City Accounting Department, Southern California Gas Company provided the information they had on record. However, the data was incomplete, which posed a problem in using that data. The provided data listed the account number, the meter number, the service address, and the usage in therms for 2005, 2006 and 2010. However, the 2005 data, which is the baseline year for this report, was not listed. Also, no data was provided on specific costs associated with each account. Logically, the City's Accounting Department Records proved more accurate for better results. It is unknown if the request for data was not specific enough and thus resulted in the data provided. It is recommended to have better communication with the point of contact from Southern California Gas in the specific data requested.

David Brletic, the City Planner at the beginning of this project, assisted in whom to seek information from for each measurement. Once Mr. Brletic provided direction for each measurement, individual meetings were established. Russ Robertson, Director of Public Works, provided information and direction for Buildings and Other Facilities, Water Transport Facilities, Vehicle Fleet and Mobile Equipment, Contracted Services, Refrigerants, Government Generated Solid Waste, Street Lights, Traffic Signals, and Other Public Lighting. Mr. Robertson assigned the collection of data to individuals under his direction. John Frealk is the contact for the Backup or Off Grid Power. The "Backup or Off Grid Power" section is defined as power that may be produced in-house by a building or a facility (e.g. by a backup generator). These types of stationary sources are gasoline and/or diesel powered and are included in Buildings and Other Facilities as follows: Police Department, Waste Water Treatment Plant, part of City Hall (which is powered by the Police Department) and the Fleet Maintenance Department. The City does not have data for the amount of fuel used for the backup generators. It is recommended that the City maintain records for the number of hours each generator runs as well as the starting and ending amount of fuel used per year. This will not only help with GHG Inventories for the future but also provides the Public Works Director with accurate data in the maintenance and longevity of the equipment.

The Fugitive Emissions-Leaked Refrigerants for Buildings and Facilities data is limited for the baseline year 2005. Although not in the LGO Protocol, ICLEI has recognized that many local governments have trouble meeting the data needs even of Alternative Method 2. Therefore, ICLEI has devised a simplified version of Alternative Method 2, wherein the local government proxies the base year inventory using the current inventory of equipment or vehicles. In addition, all equipment or vehicles are assumed to have been in operation for the entire year, simplifying the calculation further. Russ Robertson had one of the City's electricians gather all the data for the City's air conditioners. The Fugitive (Leaked) Fire Suppression Emissions information was not available. It is recommended that the City keep records for each year at the start and end as well as any additions to the refrigerants and fire suppressants used for the Buildings and Facilities throughout the City.

Emissions Factor

With regard to the energy provided by PG&E, a GHG emission factor[4] is a measure of the amount of carbon dioxide (CO_2) emitted per kilowatt-hour of electricity or per therm of natural gas.[5] Electricity generated from fossil fuels such as natural gas and coal produces CO_2 emissions, while some other sources of electricity (such as hydropower, wind, and nuclear power) do not generate CO_2 emissions. The electricity that PG&E delivers to customers comes from a variety of generation sources in any given year. Since PG&E's electricity sources vary, the GHG emission factor for its electricity varies too.[6]

For natural gas, there is only one factor needed to estimate the GHG emissions from the use or avoided use of PG&E's natural gas, since the composition of PG&E's natural gas does not change significantly over time.
For more information regarding PG&E's emissions factors, please see the document entitled "Greenhouse Gas Emissions Factors info Sheet".

Calculation

The order of operations with the entry of the collected data in the CACP programs was as followed: for the Buildings and Facilities, Streetlights & Traffic Signals, Airport Facilities, Water Delivery Facilities, and Wastewater Facilities, all used the same method of entry as Sub-Category of "S2 – Purchased Electricity" for electricity and "S1 – Stationary Combustion" for natural gas.

The Vehicle Fleet data was entered as Aggregate Fuel Consumption method. The data entered was set as a Sub-Category "S1 – Mobile Combustion". The data was entered by fuel type with the Coefficients of "Transport Average Set" set as "High Way Fuel CO_2 Only" and "Fuel CO_2 Set" set as "Defaults".

The Employee Commute data was entered by fuel type consumed and vehicle type. The data entered was set as a Sub-Category "S3 – Employee Commute". The data was entered by fuel type with the Coefficients of "Transport Average Set" set as "High Way Fuel CO_2 Only" and "Fuel CO_2 Set" set as "Defaults". The data entered by vehicle type had the Coefficients of "Transport Average Set" set as "Defaults" and "Fuel CO_2 Set" set as "Highway VMT N2O, CH4 and CAP".

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[4] An emission factor is also known as an emission rate or emission coefficient.
[5] There are also many other types of GHG emission factors. For example, there are emission factors for diesel, coal, and other fuels, as well as estimated emission factors for vehicles, landfills, and other products and processes. See the ICLEI Local Government Operations Protocol for some examples.
[6] PG&E and other utilities purchase some of their electricity from a power pool for re-sale to customers. It is not possible to trace that electricity back to a specific generator, for the same reason that a share of stock purchased through a stock exchange cannot be traced back to a specific seller. An emission factor for such purchases is therefore estimated.

The City's Building and Facilities refrigerants data was entered into the "Other Process Fugitive" tab by facility and refrigerant type. The data entered was set as a Sub-Category "S1 – Fugitive Emissions".
The Fleet Vehicles and Transit Vehicles refrigerant data was entered in the "Mobile Source Refrigerants" tab. The entry of that data was the same as the City's Building and Facilities refrigerants data as mentioned above.

Limitations

The data that was not collected is as follows: The City does not have data for the amount of fuel used for the backup generators. It is recommended that the City maintain records to the number of hours each generator runs, the starting and ending amount of fuel used per year. This will not only help with GHG Inventories for the future but also provides the Public Works Director with accurate data in the maintenance and longevity of the equipment. As mentioned above, the City does not have records of the vehicle refrigerants data. It is recommended that the City keep records of detailed capacity of refrigerants at the start and end, as well as additions to the refrigerants systems of not only the Vehicle Fleet and Transit Fleet but also each air conditioning unit. The Fugitive (Leaked) Fire Suppression Emissions information was not available. It is recommended that the City keep records for each year at the start and end, as well as additions to the refrigerants and fire suppressants used for the Buildings and Facilities throughout the City. The data for the Fire and Police Department's use of fire suppressants was not available and it's recommended to keep records for each year.

Buildings and Other Facilities

Collecting data for the City of Reedley's Buildings and Other Facilities consisted of inquiry into what information was available by meetings with specific heads of City departments. Each individual provided information that was available and not available for each specific measurement in the LGO protocol.

Streetlights, Traffic Signals, and Other Public Lighting

The streetlights, traffic signals, and other public lighting are powered by Pacific Gas & Electric. There are no backup generators and direct access power for the streetlights, traffic signals, and other public lighting.

Water Transport Facilities

The water transport systems (including sewage and storm water) are powered by Pacific Gas & Electric. There are back generators at the water well pumps and sewer lift stations. John Ornellas is the contact for the water transport system. There is no direct access power for the water transport system.

Wastewater Treatment Facilities

The wastewater treatment facility is powered by Pacific Gas & Electric. There are back generators for the wastewater treatment facility and sewer lift stations; however no data is available for them.

Airport Facilities

The City of Reedley owns and operates an airport. The electrical power is provided by Pacific Gas & Electric. There is a propane tank used to heat water in the main building on the property, however no data was available. It is recommended to keep the records or purchased fuels like propane.

Vehicle Fleet and Mobile Equipment

The Vehicle Fleet posed a challenge to collecting data. Gathering information on each vehicle and each piece of mobile equipment proved to be not possible. There were no records for the vehicles and equipment used, the miles the vehicle traveled or operated, and the amount of fuel used during our baseline year of 2005. As a result, the Aggregated Fuel usage method was utilized. Through City Accounting Department documents, the information on the purchased totals of fuels, the type, and the costs were available. The department that purchased the fuel was also available. It is recommended that the Vehicle Fleet and Mobile Equipment, and those departments responsible for the equipment, keep more detailed records. The system in place during the calendar year of 2005 was missing odometer readings. It is recommended that each City vehicle or piece of equipment being checked out have its miles or hours of operation recorded as well as the amount of fuel used.

Employee Commute

The Employee Commute data was collected with the help of the City Manager's Office. A paper copy of the survey was distributed to each department along with a letter from the City Manager, Nicole Zieba. The paper copies were collected and hand-entered into the MDW. There were a very limited number of Internet surveys that were entered as well. Out of the 110 employees of the City, 98 responded. That was an 89% response rate, which is very high.

Appendix B: Project Resources

ICLEI created various tools for the City of Reedley to use to assist with greenhouse gas emissions inventories. These tools are designed to work in conjunction with LGO Protocol, which is the primary reference document for conducting an emissions inventory. The following tools should be saved as resources and supplemental information to this report:

- The "Master Data Workbook", an Excel-based tool that contains most or all of the raw data (including emails), data sources, emissions, notes on inclusions and exclusions, and reporting tools;
- The "Data Gathering Instructions", an instructions guide on the types of emissions and data collection methodology for each inventory sector;
- The "Quality Control Checklist for Master Data Workbook", a checklist which provides a list of items to review in the Master Data Workbook to ensure information was entered correctly;
- The "CACP 2009 Data Entry Instructions", an instructions guide on how to enter data collected in the Master Data Workbook into the Clean Air and Climate Protection Software (CACP 2009), ICLEI's greenhouse gas emissions calculator;
- The CACP 2009 "Backup" files, a group of files which contain the calculations of emissions based on inputs from the Master Data Workbook into CACP 2009. The CACP 2009 software is required to open the Backup files;
- The "Checklist for Reviewing the Government Analysis Inputs/Outputs, Details Export" a checklist which provides a list of items to review in this CACP 2009 export file to ensure information was entered correctly;
- CACP 2009 "Government Analysis Inputs/Outputs, Summary with Notes Export", an Excel-based export file which contains a summary report of all calculated emissions, with explanatory notes included;
- CACP 2009 "Government Analysis Inputs/Outputs, Details Export", an Excel-based export file which contains a detailed report of all calculated emissions;
- The "Completing the Inventory Report", an instructions guide from ICLEI on how to report greenhouse gas emissions according to the LGO Protocol;
- The "Charts and Tables Data Conditioning Sheet", an Excel-based tool created by ICLEI and completed by the author to aid in creating the charts and tables within the Master Data Workbook;
- A presentation with slides completed by the author to summarize findings from the greenhouse gas inventory.